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ELLIS ISLAND SEAWALL

HISTORIC STRUCTURE REPORT

Ellis Island
Statue of Liberty National Monument

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Architectural Preservation Division
Northeast Region
National Park Service
U.S. Department of the Interior
New York, New York

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MANAGEMENT SUMMARY

The perimeter of Ellis Island is defined by a granite- faced concrete seawall that rises from New York Harbor's water, forming a protective wall for the fill and cribwork that comprise the bulk of the island's acreage. The history of the seawall's evolution is tied closely to the evolution of the island itself. Sections of seawall were often constructed or replaced in conjunction with the expansion of the island's boundaries to accommodate its changing function, architecture, and spatial use.

Originally only 3.5 acres in size, Ellis Island was expanded three times between 1890 and 1906 using landfill contained by a wooden crib bulkhead. Between 1913 and 1920, the wooden bulkhead was replaced around much of the island with the granite- faced concrete seawall that exists today, utilizing different engineering solutions to accommodate the variable harbor bottom conditions and the existing wooden crib infrastructure. The seawall, and the island, attained their present form in the years 1933- 1934 when the masonry seawall was extended along the northwest side of the island complex, supporting fill for an addition in the center of this side, and around the northeast corner and point of the island.

Within a decade of the masonry seawall's completion, problems began to arise in the structure of the essentially manmade island. Unfortunately, many of these were the same problems that the replacement of the wood cribwork with masonry had been intended to solve. Fill material settled and washed through gaps in the masonry construction, which caused sinkholes to develop in the land along the inside perimeter of the wall. As the wall's deterioration progressed to include mortar washout, stone- block displacement, and concrete cracking, the loss of island fill accelerated and the wall destabilized further. Although numerous maintenance campaigns and stopgap measures have been taken to address these problems and halt the cycle of fill attrition and wall deterioration, structural problems with the seawall and the fill it contains continue to this day. Current conditions potentially threaten the stability of the Ferry Building, the integrity of the landscaping, and the safety of the visiting public.

This historic structure report (HSR) is intended to serve a planning document for the Ellis Island Historic Seawall Rehabilitation, and as a resource for the long- term maintenance of the structure. The seawall rehabilitation is a collaborative effort between the U.S. Army Corps of Engineers, New York District (COE); the Denver Service Center (DSC) of the National Park Service (NPS); and the Statue of Liberty National Monument/Ellis Island National Historic Site (STLI/ELIS). This HSR will provide the Corps of Engineers (which has submitted the schematic design for the rehabilitation) and the park with a developmental history and comprehensive description of the structure. Its objective is to aid in design, rehabilitation, and maintenance decisions, so that the seawall's unique structural problems can be addressed while minimizing loss of historic material and alteration of the historic structure.

This HSR was undertaken as a project agreement between the Building Conservation Branch (BCB) of the Northeast Cultural Resources Center (NCRC), the Statue of Liberty National Monument and Ellis Island (STLI/ELIS), and the Denver Service Center (DSC). The report outlines the developmental history of the seawall and documents the techniques, materials, and construction of each of its phases. Although investigation was limited to nondestructive methods, consisting of archival research and field observation of the COE's test pits, the level of research that was undertaken can be classified as "exhaustive" as defined by *NPS DO-28*.[1] All extant primary and secondary sources of known relevance were consulted, including some archival sources that have not been referenced in earlier Ellis Island reports. (See Part I, "Introduction, Administrative Data.")

Primary source material examined included construction drawings, specifications, contracts, correspondence, and photographs. Most of this material was found in the National Archives and Records Administration (NARA) repositories in Washington D.C. (NARA I); College Park, MD (NARA II); and New York City (NARA NYC). Many of the drawings were found on a two-CD set containing images culled from the NPS Technical Information Files at the DSC. The archival record for the seawall is fairly complete, and provides a comprehensive picture of the seawall's construction. The conformity of the construction photographs and recent test-pit and diver data to the specifications of the original construction documents suggests that the planning materials provide a fairly accurate picture of the seawall "as built."

Additional historical photographs, magazine articles, and newspaper clippings were examined in the Statue of Liberty/Ellis Island Library, the New York Public Library, the Library of Congress, the New York Historical Society, and the Museum of the City of New York.

Secondary sources consisted of NPS planning documents, including earlier historic structure reports, a cultural landscape report, and several engineering reports. These documents are discussed in Part I, "Introduction, Administrative Data."

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[1] Although mortar analysis was originally included in the project agreement for this report, it became apparent from examining maintenance records and interviewing maintenance personnel that there was no known original mortar on the earliest parts of the seawall, and that mortar analysis would thus be of very limited use. Additionally, as research progressed it became clear that the main objectives of mortar analysis, including mortar composition and the wall's construction chronology, could be met using archival means.

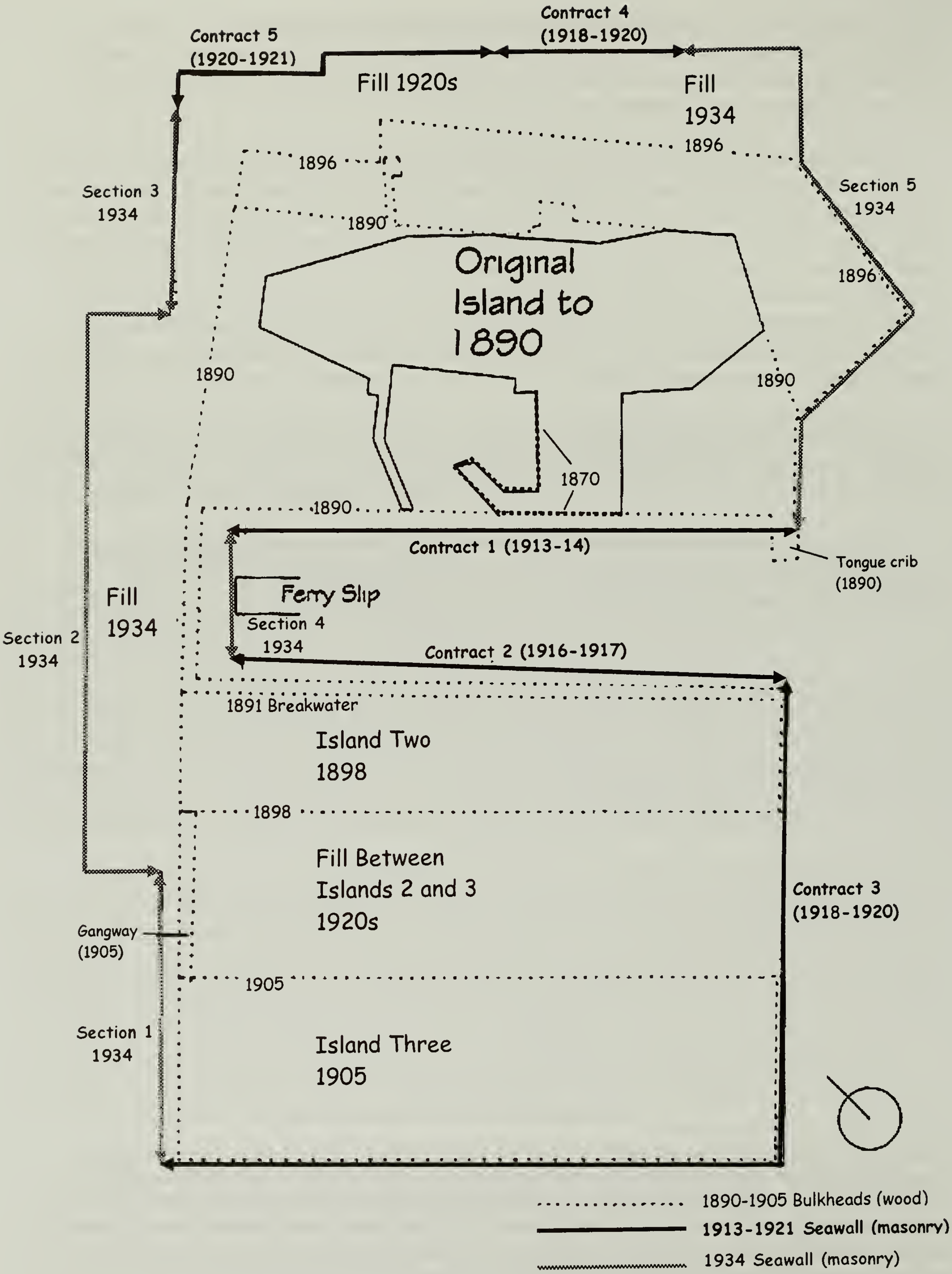

Figure A. Historical development of Ellis Island and its seawall.

PART I.

INTRODUCTION

STATEMENT OF SIGNIFICANCE

The Ellis Island Seawall, constructed in phases between 1890 and 1934, forms the perimeter of the entire island, protecting and retaining the landfill that comprises the majority of the island's mass. As such, the seawall serves a critical structural function for the landscape and buildings of Ellis Island. The seawall is also an important historical feature of the island. As an integral part of the island's construction, its development represents the evolution and 20th-century expansion of the island itself.

ADMINISTRATIVE DATA

The Ellis Island Seawall surrounds the perimeter of Ellis Island, which is situated in New York Harbor's Upper Bay on the New Jersey side of the Hudson River. The island lies approximately one and one- half miles southwest of Manhattan Island and three- quarters of a mile north of Liberty Island.

In the List of Classified Structures (LCS) for the Statue of Liberty NM, the seawall (IDLCS 40472, Structure Number HS44) is listed as 1. "Granite Seawall," and 2. "Granite- Faced Sea Wall." It is classified as a "peripheral structure" of Ellis Island. Its proposed treatment is rehabilitation.

Until recently, the seawall was not recognized as an important element of the island's cultural landscape or historical development; mention of the structure is all but absent from early NPS planning documents. Harlan Unrau's 1981 *Historic Structure Report, Ellis Island, Historical Data* describes the timber crib bulkheads of the 1890 through 1906 island extensions, but does not discuss any further development of the seawall in his text. (Later seawall phases are vaguely labeled in his schematic Historical Development plans of the island.) The 1984 *Historic Structure Report, The Main Building* by the architectural firm Beyer Blinder Belle, which contains a historical landscape section, has no discussion of the seawall.

Two recent NPS planning documents that do mention the seawall are Patrick Eleey et al.'s *Cultural Landscapes Inventory, Ellis Island* (2000), and J. Tracy Stakley's *Cultural Landscape Report for Ellis Island: Site History* (2003). These reports were produced by the Olmsted Center for Landscape Preservation, in Brookline, Massachusetts. The "Chronology" section of the cultural landscapes inventory contains incomplete references to the seawall and incorrect dates for several of its entries. The cultural landscape report provides an excellent if brief account of the seawall's development in the context of the historical evolution of Ellis Island's landscape.

At several times in the history of the park, the NPS has contracted architectural or engineering firms to produce reports that address repair and stabilization of the seawall. These are: *Seawall Rehabilitation and Walk Repair- Ellis Island* by URS/ Madigan- Praeger (1976), *Project Manual for Docking Facilities and Seawall Repair,* by Beyer Blinder Belle (1987), and most recently, *Condition Survey: Ellis Island Ferry Slip,* by Mueser Rutledge Consulting Engineers (2000).

It should be noted that although the URS/ Madigan- Praeger report is a detailed study of the seawall, with a careful condition survey, good conclusions, and a helpful concrete- analysis appendix (reproduced here in Appendix F), there are a number of inaccuracies and omissions in the site plan and detail drawings that describe the historical types of wall construction. The authors did not access a portion of the original archival information that would have provided more accurate construction details and dates.[1]

ARCHITECTURAL DESCRIPTION

The Ellis Island Seawall is a granite- faced concrete structure that surrounds the entire island. The total linear footage of the seawall is more than 6,700 feet, or about a mile. The wall extends almost 10 feet (4.5 courses) above mean low water, with a slight batten around most of the island. The face of the seawall is perpendicular to the plane of the water northwest of the ferry basin (in front of the ferry building) and behind Islands Two and Three on the northwest side of the island (facing New Jersey). The stone facing consists of rock- faced blocks of pale pink granite with a fine linear grain, laid in alternating header and stretcher directions and capped with bush- hammered coping stones.

Around most of the island, the land's grade is almost flush with the rear of the coping stones. In these areas the coping stones have a bull- nosed (rounded) profile on their front face. Around the southeast point and in the center of the northeast side, however, the seawall has three additional, thinner courses on top that form a parapet wall extending several feet above grade. At the bottom of the parapet wall, at grade level, periodic square openings through the stone (slightly higher than a course) allow for drainage. The parapet coping stones are slightly peaked, with bronze strap cramps between each stone.

Along the north of the ferry basin, in front of the Main Building, squared backing logs are bolted to the upper face of the seawall for protection of the wall and ferries during docking. Metal railings for visitor protection are bolted to the top of the coping stones. Three concrete ramps have also been built into this stretch of the seawall. Iron mooring bollards are bolted into the tops of the seawall along both sides of the ferry basin. At the northwest corner of the island, wood backing logs and mooring piles bolted into the seawall also allow for ferry docking.

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[1] That URS/ Madigan- Praeger's construction details were only partially correct was first noticed by the COE engineers upon digging test pits along the southeast and southwest edges of Islands 2 and 3. Original drawings found subsequently conformed to the test pit results rather than those proposed by the 1976 study.

A NOTE ON TERMINOLOGY AND SCOPE

The term "seawall" is used to denote a structure that both protects the land behind it from erosion by wave action, and that retains this land from falling into the sea. It is often used interchangeably with the term "bulkhead," but as the U.S. Army Engineer Manual on the subject notes,

> A bulkhead is primarily intended to retain or prevent sliding of the land, while protecting the upland area against wave action is of secondary importance. Seawalls, on the other hand, are more massive structures whose primary importance is the interception of waves.[2]

Ellis Island has had two types of such constructions throughout its immigration and post- immigration history, a wooden crib begun in 1890 that fully surrounded the island by 1907, and a masonry wall begun in 1913 that surrounded the island by 1934. Although the terms "seawall" and "bulkhead" are defined independently of the material of construction (a seawall need not be masonry, nor a bulkhead wood), in this report, the wooden crib construction will generally be referred to as a "bulkhead" and the masonry one as a "seawall." This is done both for clarity and following the lead of the historical documents, while recognizing that the wood bulkhead had some of the protective characteristics of a seawall and the masonry seawall the retentive qualities of a bulkhead. Both structures, the earlier wooden one and the later masonry one, performed essentially the same function.

It should also be noted that although in this report the masonry seawall is stated to have "replaced" the wooden crib bulkhead between the years 1913 and 1934, this was a replacement in function only. In almost all cases, the wood crib below the water line remained intact and the masonry seawall was built on top of it or front of it at varying distances, removing the old cribbing above the water line only. For this reason, this HSR gives detailed descriptions of the construction of both the original wooden crib bulkhead and the present granite- faced concrete seawall, discussing both as a developmental continuum. The original wood cribbing is still in place around (and presumably under) most of the island, below water and below grade, and as such must be considered a historically significant structure that may be impacted when planning for the rehabilitation of the seawall.

To aid the reader, a glossary of relevant seawall- related terminology is provided in Part V.

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[2] U.S. Army Engineer Manual 1110- 2- 1614, *Design of Coastal Revetments, Seawalls, and Bulkheads*, April 30, 1985.

PART II.

HISTORICAL DATA

PRIOR TO IMMIGRATION: BEFORE 1890

Ellis Island has a long pre- immigration history as a small islet used first for its natural resources and later as a military fortification. It passed from Native American to colonial Dutch ownership in 1630, to New York merchant Samuel Ellis in 1794, and then to the State of New York (which subsequently ceded it to the federal government) in 1808. In the months preceding the War of 1812, the Department of War expanded the existing defensive buildings at the southeast end of the island, upgrading an earthen rampart to a masonry parapet with 13 embrasures. At this time, too, the island received its first seawall structure, a low masonry wall that surrounded the island at its high water mark. This wall can be seen in an 1813 plan and elevation of the island (fig. 1). The fortification was named Fort Gibson the following year. Maps of the island from 1853, 1854, and 1864 explicitly label the south portion of the wall in front of the parapet "seawall."[1]

In early 1870, a wood crib seawall was built around much of the island along the inland high- tide line where the low masonry wall of 1813 had been.[2] A map from March 26, 1870, notes the "new sea wall" along the island's north and west sides (fig. 2). An 1890 plan, made shortly before the wall's demolition, reveals that it consisted of open cribs (fig. 3). Plank walks along the northeast and southwest shorelines of the island were presumably also situated on or next to wood crib seawalls as well. The 1870 wood crib seawall was built in conjunction with a number of improvements that the Navy made to the island, which by now was used exclusively as a gunpowder storage depot. Also in 1870, the hook- shaped jetty on the south side of the island, shown on maps as early as 1800 and prominent on the 1813 plan (fig. 1), was expanded to accommodate railroad tracks leading to the magazines and two cranes at their end (fig. 2).

These early seawalls, the low masonry one and later crib one, do not for the most part bear any relationship to the cribbing and wall that surround the island today. The early seawalls were built on the 3.5 acres of the island's original landmass, to protect the inner part of the island and its buildings from tidal and wave erosion. With the exceptions of the jetty and two additional 1870 dock extensions, the shape of Ellis Island essentially conformed to its natural contours for all of its pre- immigration history. The history of the present seawall dates from the beginning of the island's use as an immigration station in 1890, when the artificial expansion and shaping of the land mass to accommodate the island's new function began.

One part of pre- immigration cribbing, however, does relate to later seawall construction. The 1890 specifications for the island's expansion direct that 163 feet of existing "old crib" be incorporated into a new crib running along the south side of the island. The "old crib" likely dates from the 1870 expansion of the ca.- 1800 jetty, which would have required new cribbing along its front to accommodate the fill for its enlargement and the heavy cranes and railroad infrastructure placed upon it. The incorporation of the existing crib is discussed subsequently.

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[1] Map of "Ellis' Island," 1854; Sheet 51, Drawer 38; Record Group (RG) 77; NARA II. Also "Map of Ellis' Island," August 1853; Dwg. 1, Red 460; RG 74; NARA II. Also Map of Ellis Island, Bureau of Ordinance, May 30, 1864; Dwg. 2, Red 460; RG 74; NARA II.

[2] By 1870, the low masonry wall may have no longer existed; it is not shown on the 1864 map referenced above or on one from 1866 (Dwg. 5, Red 460; RG 74; NARA II).

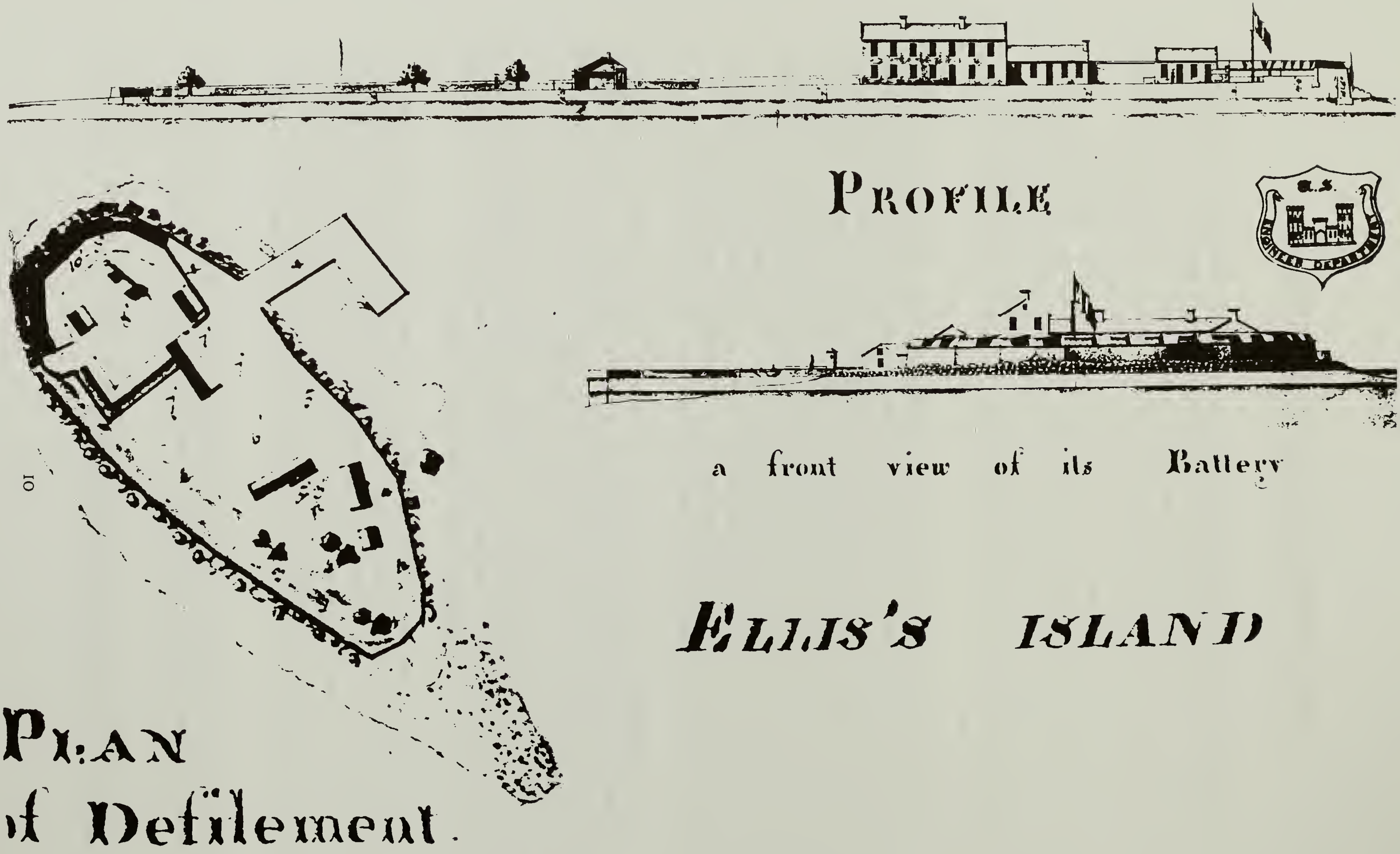

Figure 1. Details from drawing of fortifications in New York Harbor, 1813.

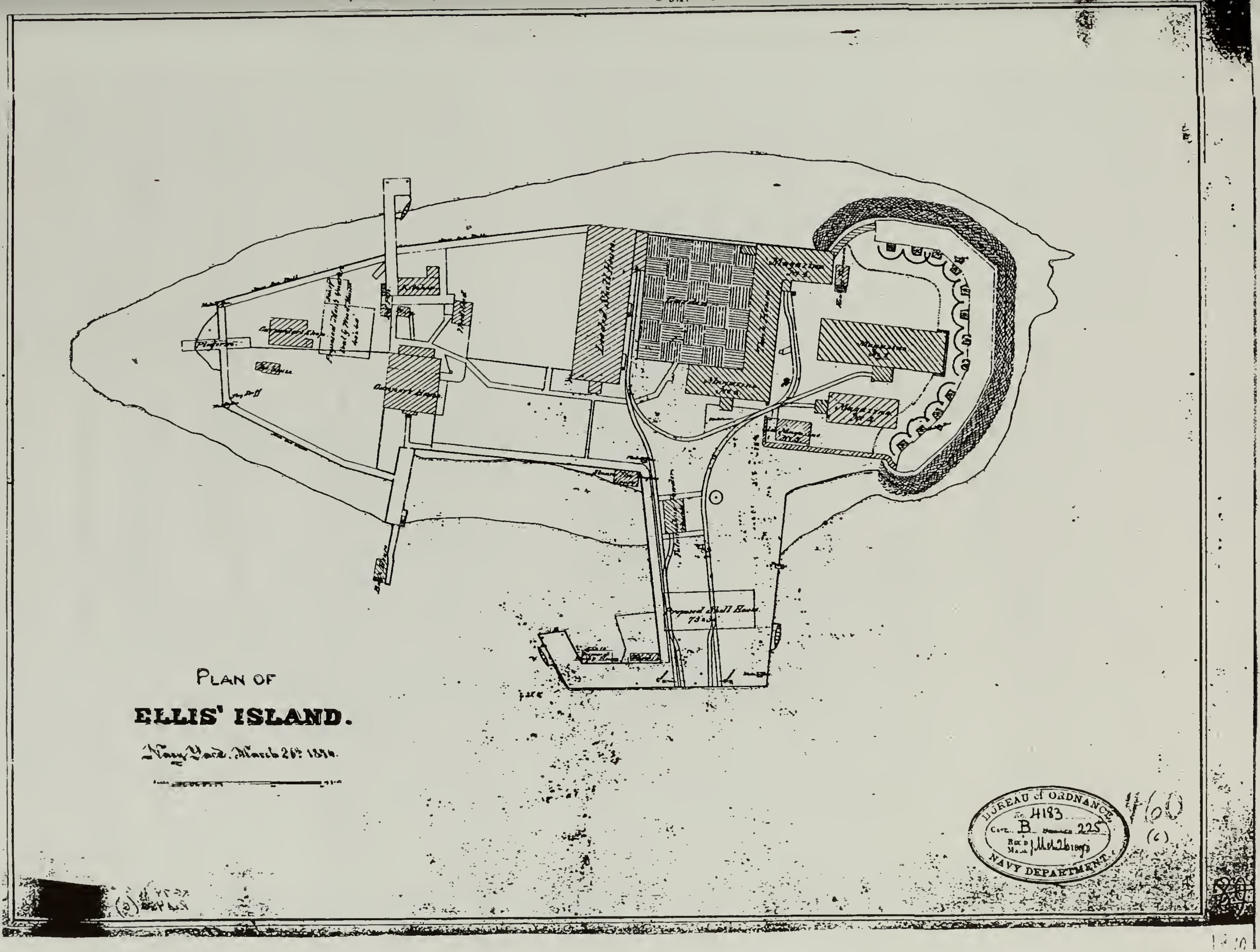

Figure 2. Plan of Ellis' Island, March 26, 1870.

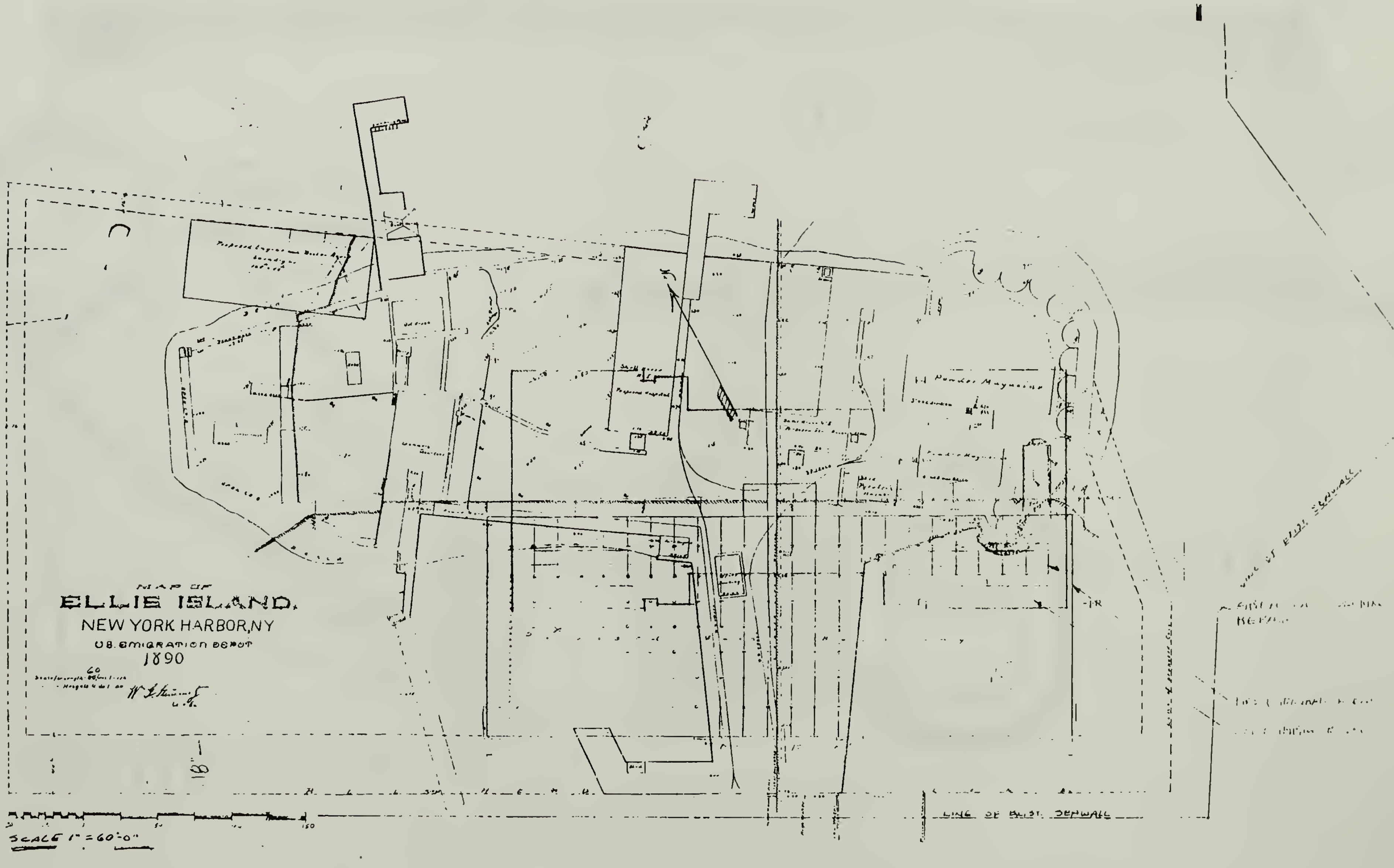

Figure 3. Map of Ellis Island, 1890. Note later annotations at far right.

FIRST IMMIGRATION STATION, 1890-1897

Beginning in 1855, immigrants arriving in New York Harbor were processed at Castle Garden at the southern tip of Manhattan, a facility that was operated by the State of New York. In 1882, immigration into the U.S. became federally centralized under the Department of the Treasury. The increasing volume of immigration through the harbor, coupled with charges of mismanagement by the State, caused Treasury Department representatives to seek a new isolated, federally controlled arrival venue. After considering both Governors Island and Bedloe's Island for this purpose, a temporary congressional committee selected Ellis Island to house the new U.S. immigration depot in March 1890.

The following month, Congress appropriated $75,000 to build the facilities necessary to convert Ellis Island into an immigration station. Although several of the extant military buildings on the island would be rehabilitated for this purpose, most of the immigration facilities would be contained in newly constructed buildings, including a large main building, that required the expansion of the island. Congress made a second $75,000 appropriation for this purpose, and plans and specifications for crib construction and filling around the all of the island except for the northeast side were put out to bid in May 1890 (see Appendix A). The proposed crib dimensions can be seen in an 1890 map of the island (fig. 3). The cribwork consisted of a main crib across the south side of the island, a portion of which incorporated the existing crib from the face of the main jetty. The difference in construction between these two phases of construction can be seen in the main crib below the central gable in figure 4. Narrower cribs connected the east end of the main crib to the east shore of the island and enclosed the entire west end of the island (fig. 3). A tongue crib, used for docking small boats, extended perpendicularly from the east end of the main crib; this can be seen at the far right of figure 4.

Thomas Casey, a captain in the Army Corps of Engineers who had recently completed construction supervision of both the Washington Monument and the U.S. Capitol Building, was brought on detail to Ellis Island to oversee the work in July 1890.[3] W.H. Beard was contracted in the same month for dredging and for placing riprap in the cribs and dredged fill between the new cribwork and the original shoreline.[4] Warren Rosevelt was awarded a concurrent contract for constructing the cribs.[5] A second contract was let to Rosevelt in September 1891 for the construction of a crib breakwater parallel to the main crib, forming a ferry basin along the southwest side of the island.[6] When the Ellis Island Immigrant Station was officially opened on

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[3] J.H. Windrim, Supervising Architect, Treasury Department, to J.W. Marshall, Superintendent of Repairs, July 21, 1890; Box 601; Entry 8; RG 121; NARA II.

[4] Thomas Casey, Captain, Corps of Engineers, to Supervising Architect, October 8, 1890; Box 441; Entry 25; RG 121; NARA II.

[5] Thomas Casey, Captain, Corps of Engineers, to Supervising Architect, October 8, 1890; Box 441; Entry 25; RG 121; NARA II.

[6] J.H. Windrim, Annual Report of the Supervising Architect to the Secretary of the Treasury for the Year Ending September 30, 1891, United States Library of Congress, 1891.

January 1, 1892, the island's original 3.5- acre size had been increased to more than 6.5 acres.[7] The island at this period can be seen in an 1892 photograph of the immigration building, taken from the west and showing the outer face of the breakwater crib (fig. 5), and in a photograph of the main immigration building from the same period, taken from the same orientation inside the ferry basin (fig. 4).

Between 1895 and 1897, additional crib bulkheads and fill were added along the east and northeast edges of the island, increasing the island by another 2.75 acres.[8] A 1908 copy of an 1896 drawing shows the lines of the cribbing from this phase of construction (fig. 6). The cribbing around the northeast side and southeast point of the newly expanded island would continue to function as a bulkhead for the longest of any of the cribs constructed on the island: it was the last of the original cribbing to be fronted with a masonry wall, in 1933- 1934. The southeast bulkhead construction can be seen in an aerial photograph from 1926, when it was 25 years old (fig. 20).

By 1897, a timber crib bulkhead surrounded the entire perimeter of the island, which had been almost tripled in size from its original 3.5 acres.

On June 15, 1897, a fire broke out that consumed most of the structures on the island including the timber- framed main immigration building. The wood cribbing was originally assumed to have survived unharmed, and was not included in the reconstruction estimates; the "telegraphic report of the disaster" filed with the Treasury Department by the Commissioner of Immigration, J.R. Senner, made no mention of any bulkhead damage.[9] This omission must have been an oversight; a report filed several months later noted that the main crib was "bulged toward the basin and, for the greater part of the basin front, has been much damaged by fire"; this assessment is confirmed by a fragmentary photograph (fig. 7).[10]

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[7] J.H. Windrim, Supervising Architect, Treasury Department, to J.W. Marshall, Superintendent of Repairs, July 10, 1890; Box 601; Entry 8; RG 121; NARA II.

[8] J.K. Taylor, Annual Report of the Supervising Architect to the Secretary of the Treasury for the Year Ending September 30, 1897, United States Library of Congress, 1897.

[9] Acting Supervising Architect to the Secretary of the Treasury, June 18, 1897; Box 604; Entry 8; Records of the Public Building Service (RG 121); NARA II.

[10] James Low, Chief, Technical Division, to the Supervising Architect, Treasury Department, November 4, 1897; Box 442; Entry 26; RG 121; NARA II.

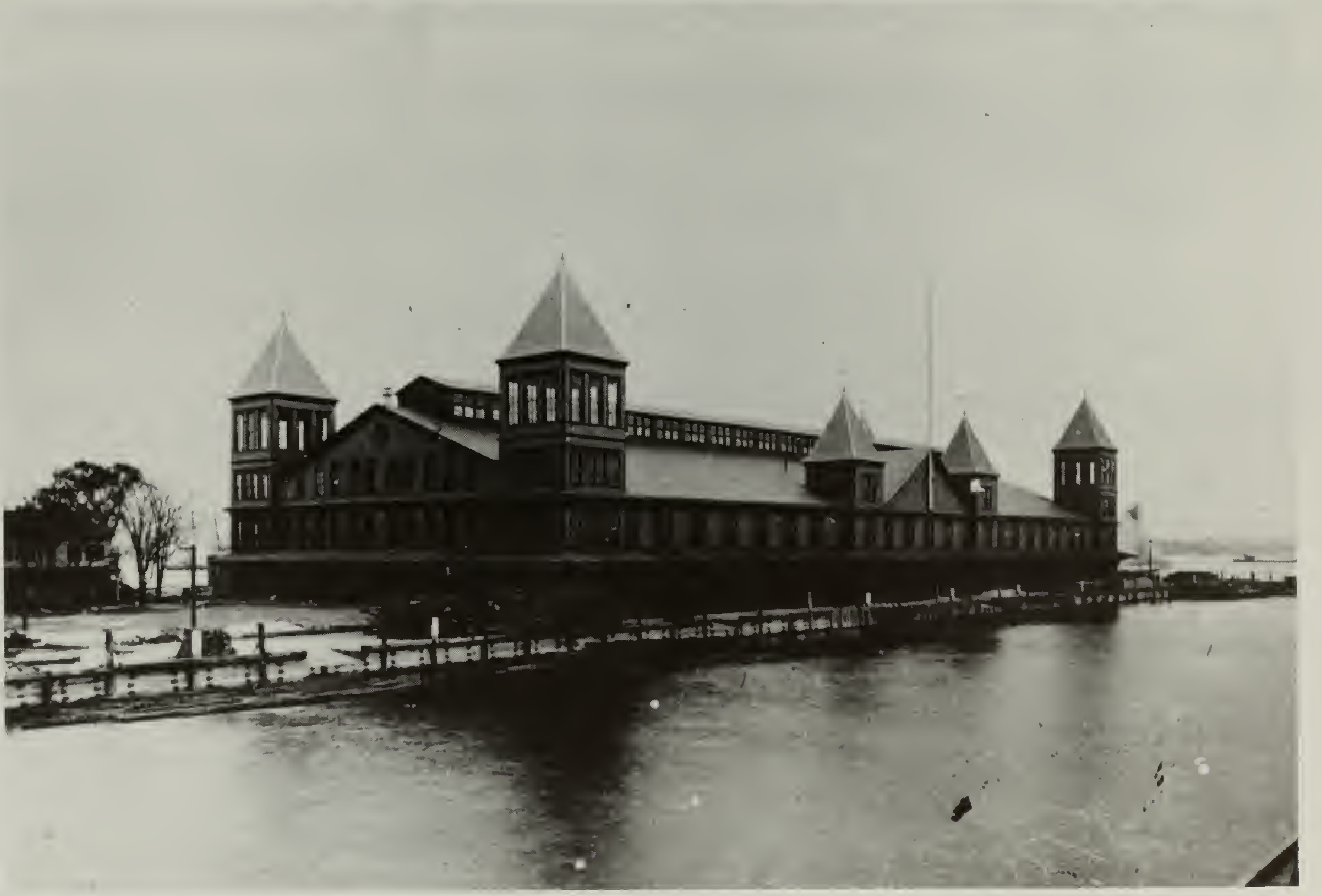


Figure 4. Ellis Island, looking east from within the ferry basin, 1892-1897. Note the section of preexisting cribbing refaced and incorporated into the center of the main crib.

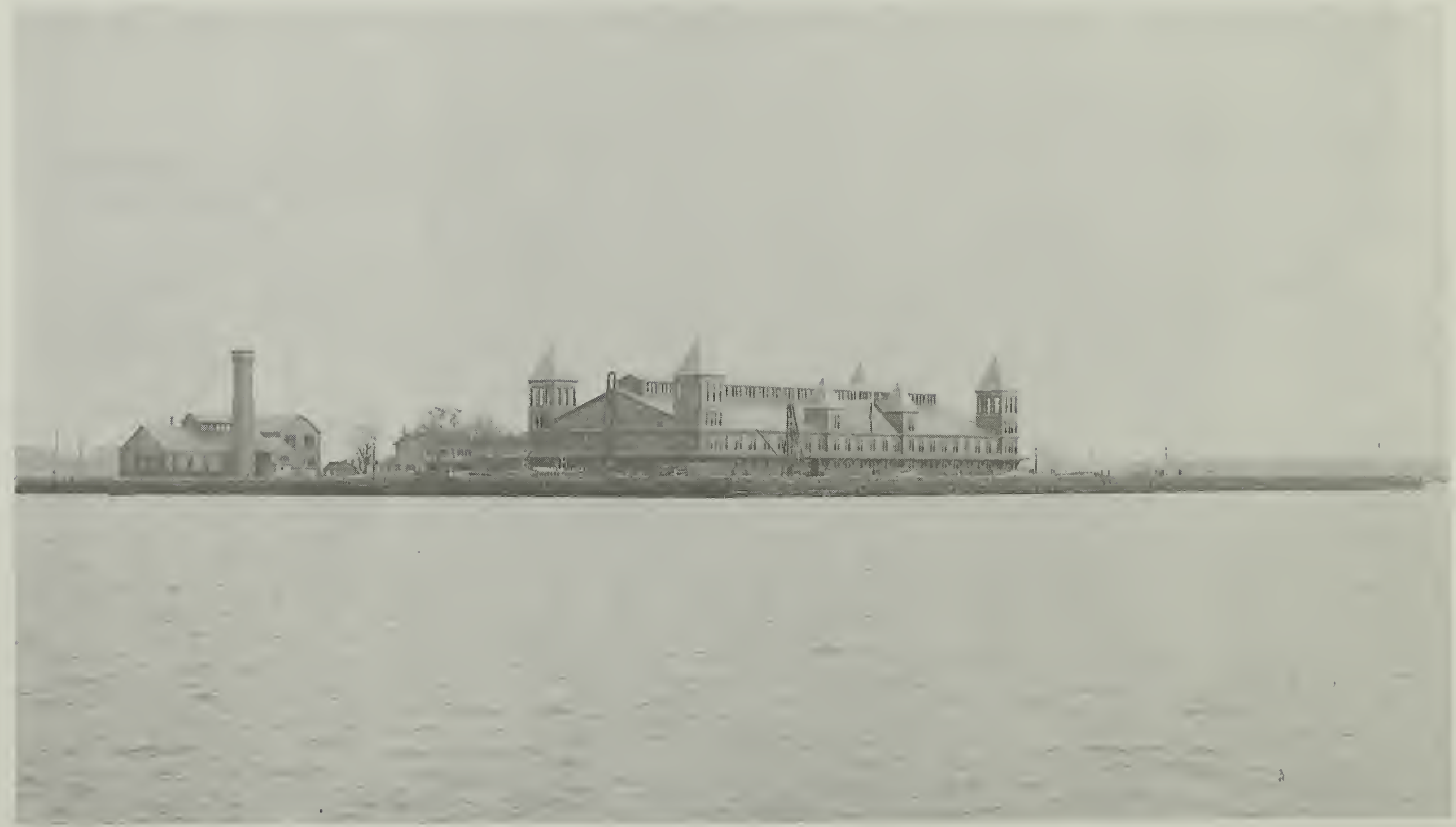
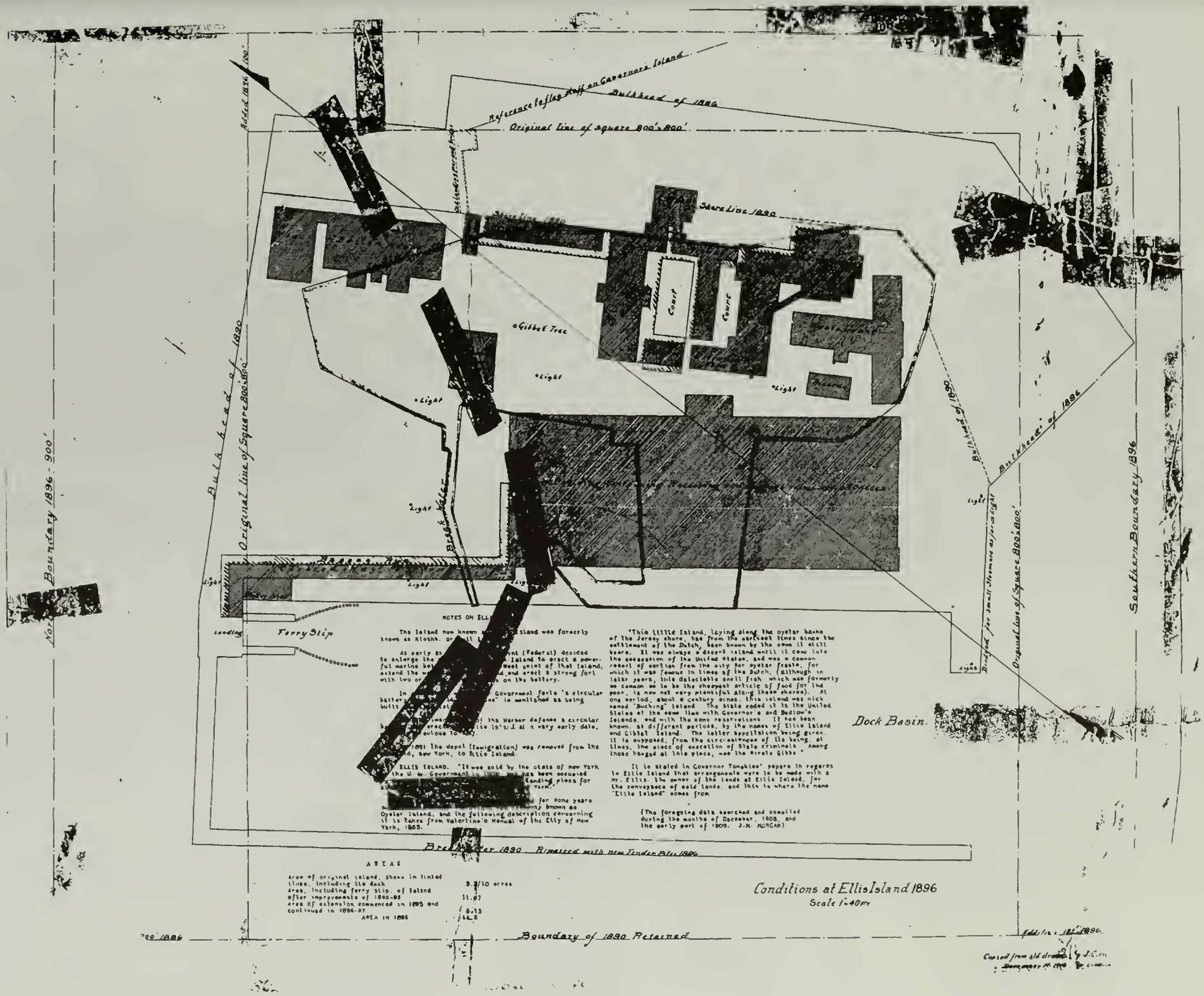


Figure 5. Ellis Island, looking east, 1892. Note that this is taken from outside the breakwater at an angle that obscures the ferry basin; also note the two different types of crib construction to the left and right.


Reference to flag staff on Governor's Island
Bulkhead of 1896
Original line of square 800'x800'
Added 1896 100'
Shore Line 1890
Court
Court
Gibbet Tree
Light
Bulkhead of 1890
Bulkhead of 1896
Break Water
Ferry Slip
Landing
Dock Basin.
Bridged for small steamers
Original line of Square 800'x800'
Bulkhead of 1890
Original line of Square 800'x800'
North Boundary 1896 - 900'
Southern Boundary 1896
Breakwater 1890 Repaired with new Fender Piles 1896
Boundary of 1890 Retained
Conditions at Ellis Island 1896
Scale 1=40 Ft
Copied from old drawing by J.C.

NOTES ON ELL[illegible]

The Island now known [illegible] Island was formerly known as Kioshk, or [illegible]

As early as [illegible]nt (Federal) decided to enlarge the [illegible] Island to erect a powerful marine bat[illegible] point of that Island, extend the w[illegible] and erect a strong fort with two or [illegible] on the battery.

In [illegible] Government forts 'a circular battery [illegible]ne" is mentioned as being built [illegible]

[illegible] of the Harbor defense a circular b[illegible] erected [illegible] lis Island at a very early date, [illegible] previous to [illegible].

[illegible] 1891 the depot (Immigration) was removed from the [illegible]d, New York, to Ellis Island.

ELLIS ISLAND. "It was sold by the state of New York [illegible] the U. S. Government [illegible] has been occupied [illegible] landing place for [illegible] York." [illegible] for some years [illegible] known as Oyster Island, and the following description concerning it is taken from Valentine's Manual of the City of New York, 1865.

"This little Island, laying along the oyster banks of the Jersey shore, has from the earliest times since the settlement of the Dutch, been known by the name it still bears. It was always a desert island until it came into the occupation of the United States, and was a common resort of parties from the city for oyster feasts, for which it was famous in times of the Dutch, (although in later years, this delectable shell fish which was formerly so common as to be the cheapest article of food for the poor, is now not very plentiful along these shores). At one period, about a century since, this island was nick named 'Bucking' Island. The State ceded it to the United States at the same time with Governor's and Bedlow's Islands, and with the same reservations. It has been known, at different periods, by the names of Ellis Island and Gibbet Island. The latter appellation being given, it is supposed, from the circumstances of its being, at times, the place of execution of State criminals. Among those hanged at this place, was the Pirate Gibbs."

It is stated in Governor Tompkins' papers in regards to Ellis Island that arrangements were to be made with a Mr. Ellis, the owner of the lands at Ellis Island, for the conveyance of said lands, and this is where the name "Ellis Island" comes from.

(The foregoing data searched and compiled during the months of December, 1908, and the early part of 1909. J.M. MORGAN)

AREAS

Area of original island, shown in tinted lines, including its dock	3.[illegible]/10 acres
Area, including ferry slip, of Island after improvements of 1890-92	11.07
Area of extension commenced in 1895 and continued in 1896-97	[illegible].13
AREA IN 1896	14.5

Figure 6. Plan of Ellis Island, 1906 copy of 1896 original.

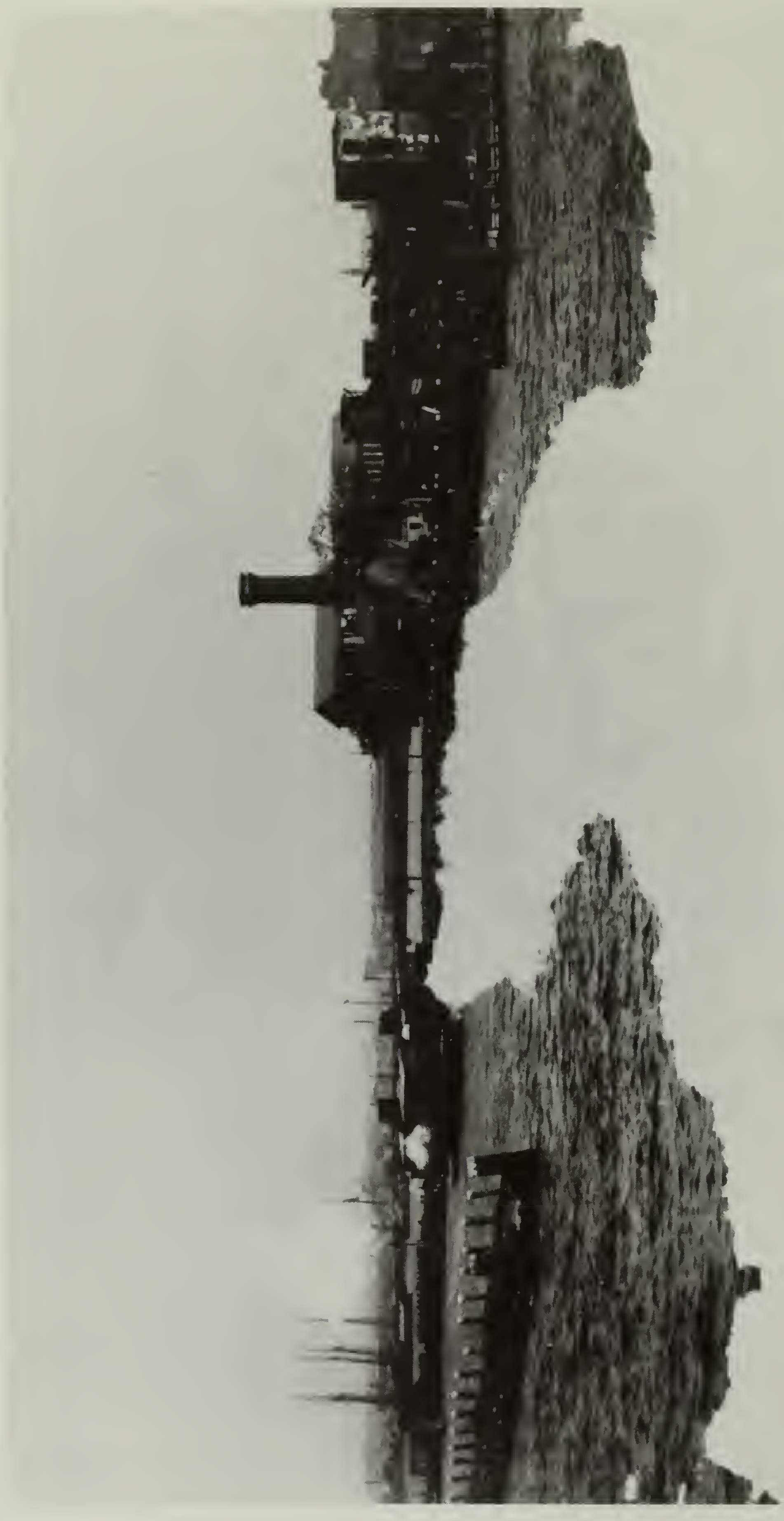


Figure 7. Photograph of Ellis Island after fire, looking northwest, 1897.

SECOND IMMIGRATION STATION AND ISLAND TWO:
1897- 1898

Almost immediately after the fire, plans were made to rebuild the immigration facility with a new, fireproof design and to enlarge the island to accommodate the increasing immigrant traffic. On June 30, 1897, Congress made a special appropriation of $600,000 for these purposes, and in August the Department of the Treasury announced an architectural competition for the improvements.[11] The firm of Boring and Tilton won with a proposal that included a monumental Beaux Arts- influenced main building, a kitchen and laundry building, a powerhouse, and—on a second island to be built to the south of the ferry slip—a hospital building. Alfred Brooks Fry, who had served as the Public Buildings Service's Chief Engineer and Superintendent of Repairs for the recently completed Post Office and Customs House buildings in Manhattan, was appointed to oversee all work; he would remain in this position for almost 20 years.

In August 1897, Secretary of the Treasury Gage obtained approval for the new island from the War Department, who still had jurisdiction over the surrounding waters.[12] Fry subsequently prepared the drawings and specifications for the new island, of which only a schematic plan exists today (fig. 8). The specifications were put out to bid in January 1898, and the contract for the island's construction was again awarded to Warren Rosevelt, the lowest bidder. The contract included dredging, construction of the cribwork, and placement and grading of the fill.

The main crib in front of the immigration building and the tongue crib at the east end of the main crib were repaired around this time. A ca.- 1897 plan of the island describes repairs to the tongue crib and makes note of the "recently repaired crib" to its west.[13] A different type of construction was used for the repaired main crib facing than existed on the damaged 1890 crib face (figs. 9 and 10; compare to fig. 4).

The existing crib breakwater at the southwest side of the ferry basin, now over eight years old, was incorporated into the structure of the island's cribwork to form the northeast side of the hospital island (fig. 11). The breakwater's condition caused delays in construction when it began to bulge into the basin during filling operations for the new island, requiring stabilization measures to be taken; these are discussed in Part III, "Physical Evolution and Technical Details: Second Immigration Station (Island Two): 1897- 1898."

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[11] Various Correspondence; Folder 1069; Box 605, Entry 8; RG 121; NARA II.

[12] L. Gage, Secretary of the Treasury Department, to the Secretary of War, August 5, 1897; Folder 1069; Box 605; Entry 8; RG 121; NARA II.

[13] NPS Denver Service Center, Technical Information Center files, STLI 43960.0009 (plan) and 43960.0008 (details).

The completion of Island Two in December 1898 added almost 3 acres of landfill to the site, increasing the total size of Ellis Island to more than 12 acres.[14] Construction began on the new hospital building and surgeon's house in 1900 and was completed the following year. This phase of the island complex's development can be seen in a panoramic photograph from 1902 (fig. 12). Closer views of the island during this time can be seen in figures 9 and 10 (both showing 1897 repairs of the 1890 cribwork), and figure 11 (showing the inner face of the 1891 breakwater incorporated into Island Two).

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[14] J.K. Taylor, Supervising Architect, Treasury Department, to the Secretary of the Treasury, February 1, 1899; Box 442; Entry 26; RG 85; NARA II.

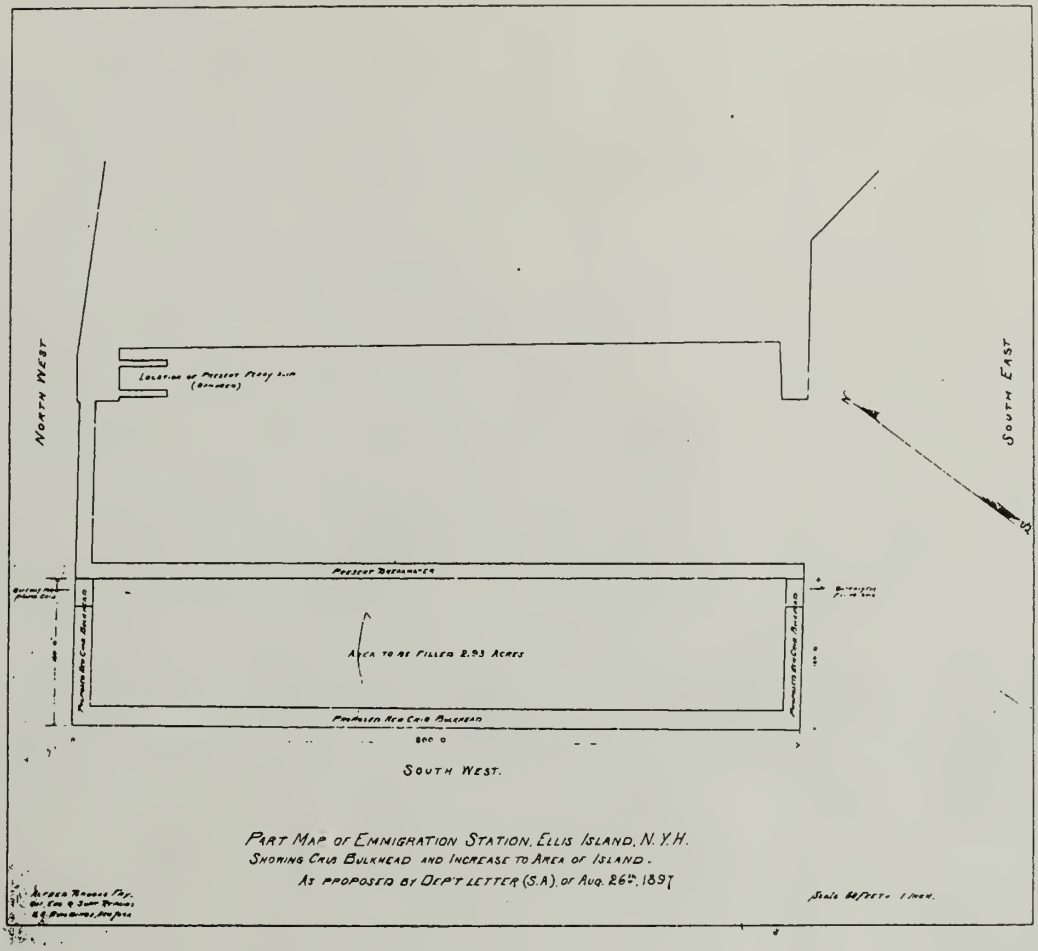

NORTH WEST
SOUTH EAST
N
S
Location of Present Ferry Slip (Enlarged)
Present Breakwater
Area to be Filled 2.93 Acres
Proposed New Crib Bulkhead
800 0
SOUTH WEST.
PART MAP OF EMMIGRATION STATION, ELLIS ISLAND, N.Y.H.
SHOWING CRIB BULKHEAD AND INCREASE TO AREA OF ISLAND.
AS PROPOSED BY DEP'T LETTER (S.A.) OF AUG. 26th. 1897
Scale 60 Feet to 1 Inch.

Figure 8. Layout plan for cribwork and landfill to create Island Two, August 26, 1897.

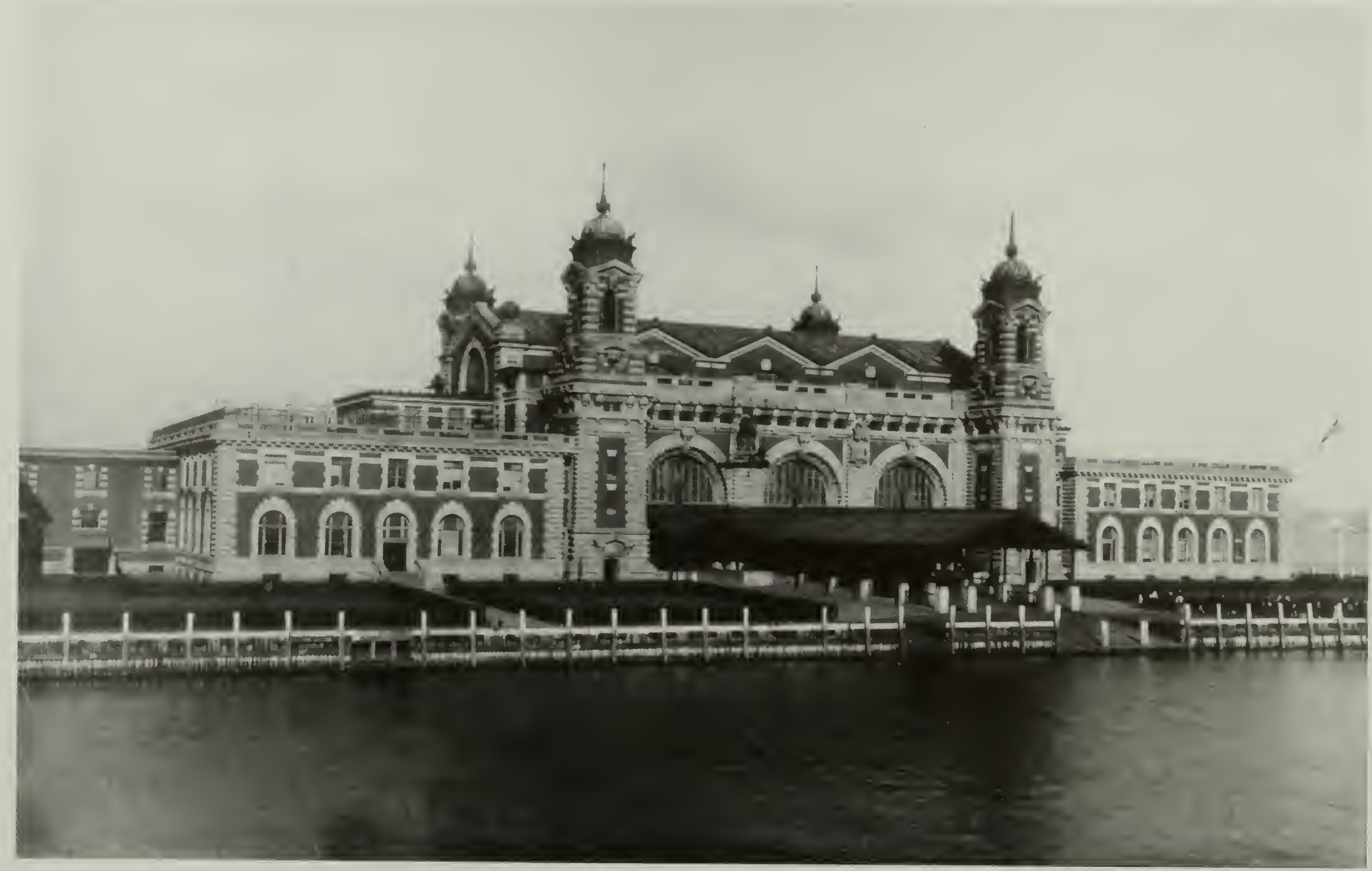


Figure 9. Ellis Island, Main Building and main crib wall, ca. 1904- 1910.

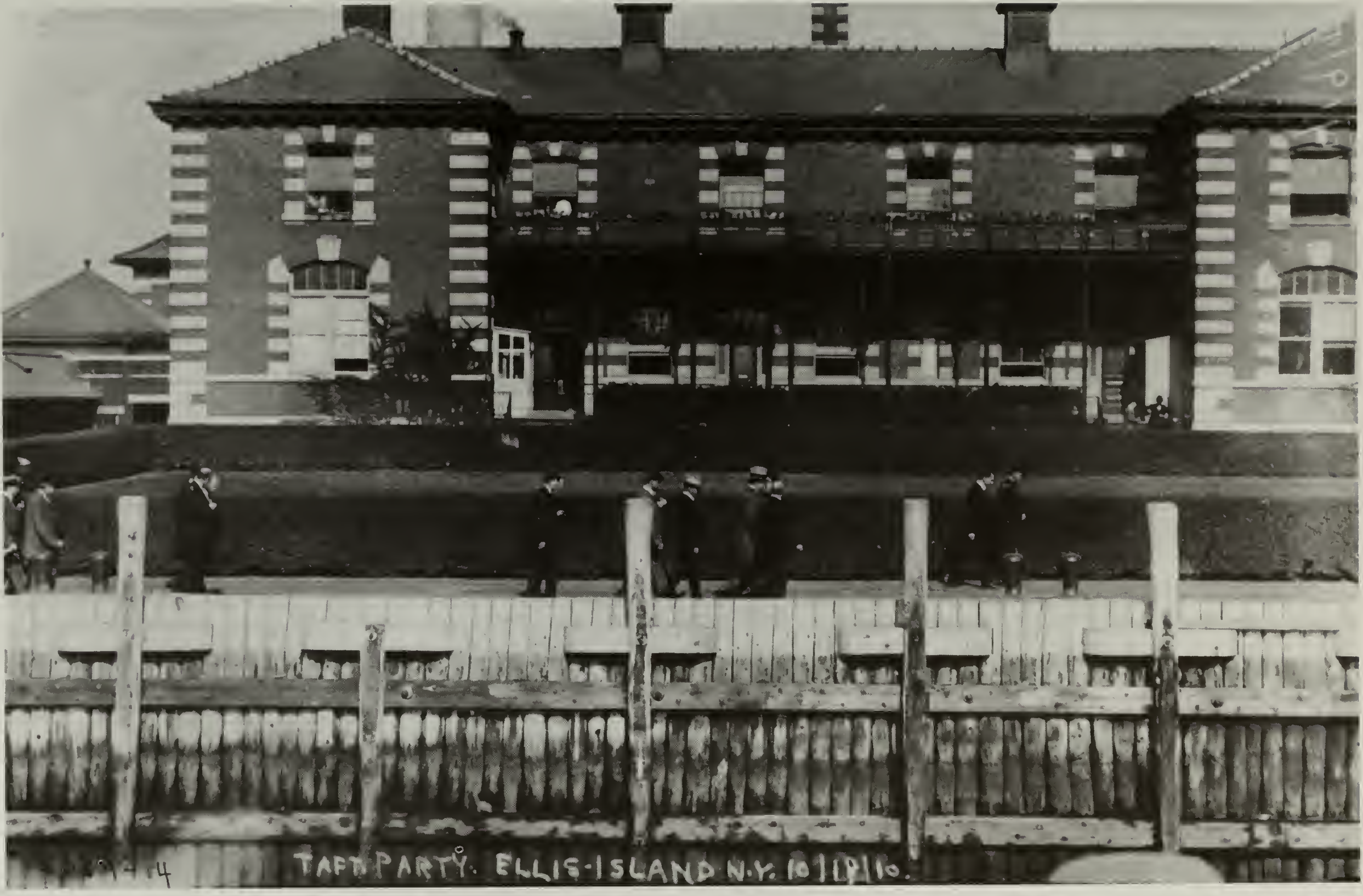


Figure 10. President Taft visiting Ellis Island, October 1910, showing west end of main crib, Island One.

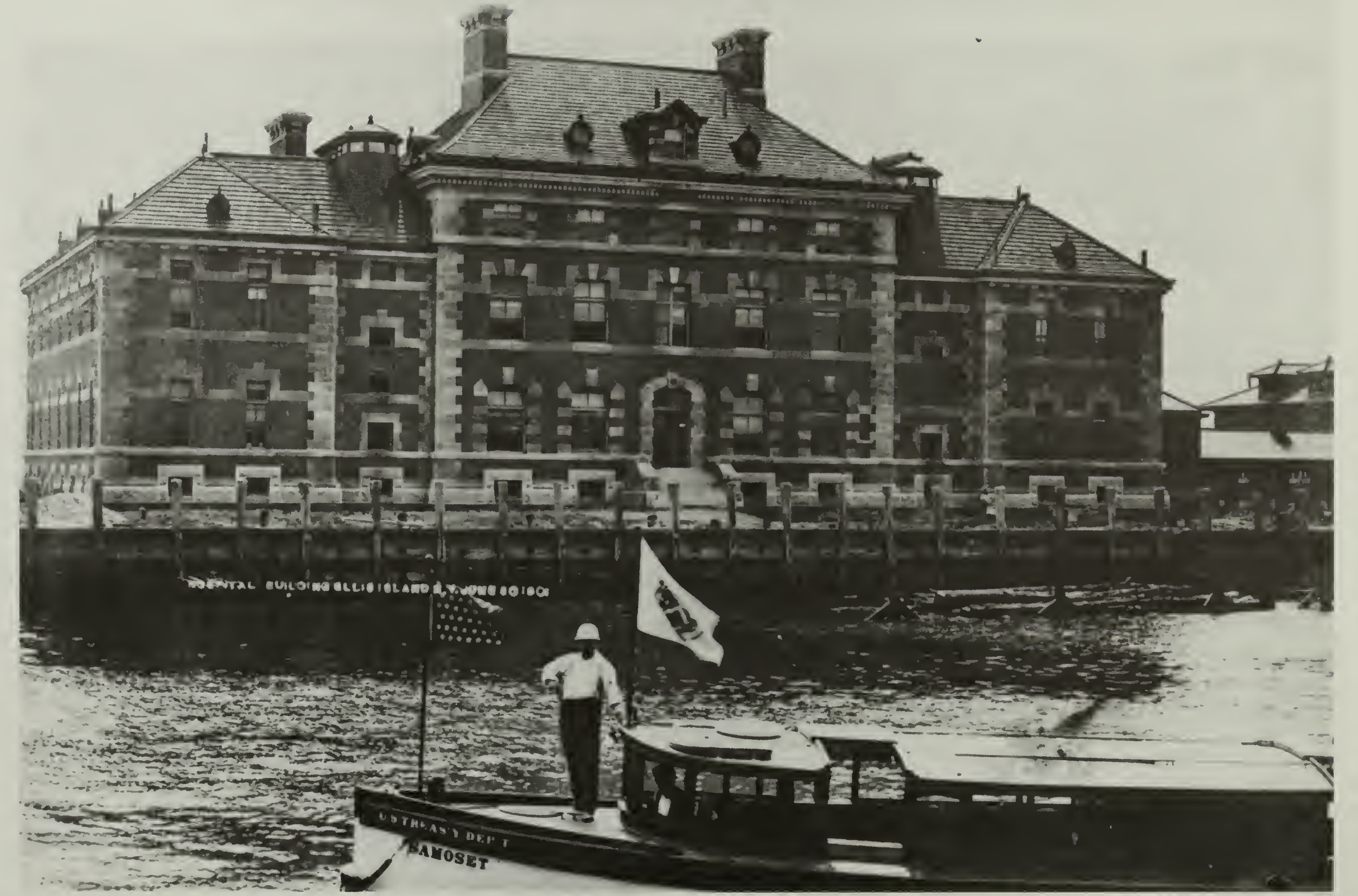
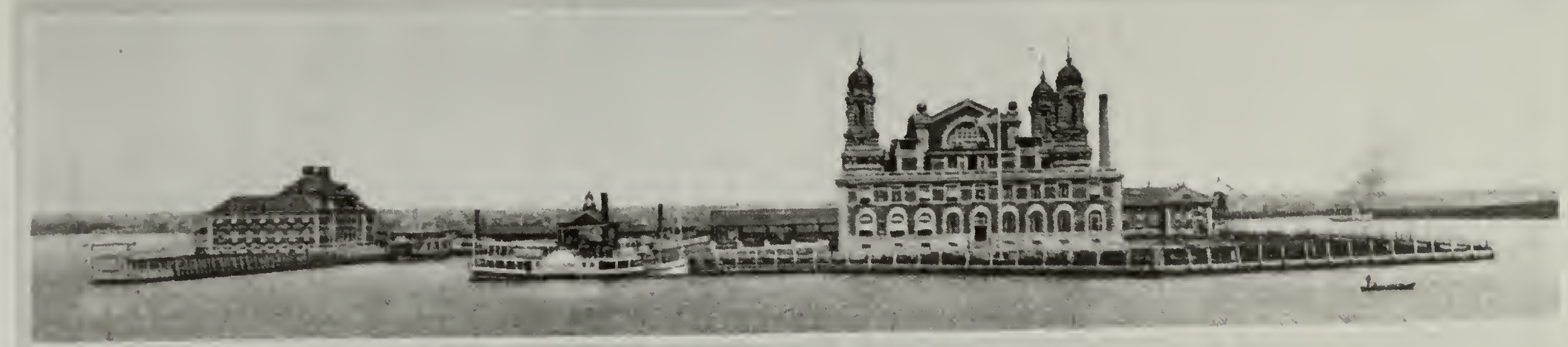


Figure 11. Island Two from Island One, June 1901. Note 1891 breakwater bulkhead incorporated into the island's construction.



NEW HOSPITAL BUILDING, ELLIS ISLAND.

Figure 12. Halftone panorama of Ellis Island, 1902.

ISLAND THREE: 1902- 1906

As immigration through Ellis Island steadily increased throughout the end of the 19th century, so too did accusations of corruption and poor physical conditions at the immigration station. It was in this climate that William Williams, a Wall Street lawyer with a background in government legal service, was appointed Commissioner of Immigration by President Theodore Roosevelt in 1902. In response to the prevailing criticism of the station, Williams immediately initiated a number of administrative changes, and—seeking to improve the island's conditions, capacity, and appearance—took a more active role than his predecessors had in the physical development of Ellis Island. One of the first major initiatives he proposed was the addition of a third island extension to house a contagious disease hospital. The new hospital building on Island Two, which had opened in March 1902, had no contagious disease facilities, and the overcrowded New York City Health Department, which had previously taken immigrant cases of that type, terminated its contract with the immigration station in September of that year.[15]

Congress appropriated $150,000 for the construction of the island in 1903 (a $250,000 appropriation for the construction of the hospital itself would follow in 1905). Dredging began in June 1904, and after lengthy negotiations with New Jersey over the ownership of submerged lands around the island, work on the island began in May 1905.[16] Alfred Brooks Fry prepared plans and specifications for the cribwork construction (figs. 24- 25 and Appendix B), and the contract was awarded to the New Jersey Dock and Bridge Company.[17] The new island was 800 feet long by 250 feet wide, located 200 feet to the southwest of Island Two. It was connected to Island Two by a gangway at the west end (fig. 13).

In March 1906, towards the end of the island construction contract, problems were encountered during the filling of the cribs when the western rear crib began to move out of place. Alfred North Fry thought that the displacement was fault of the contractors' method and demanded that the crib be rebuilt according to the original specifications. The contractors at first refused to comply, and then sued the state to recoup the additional labor and material costs they incurred. The case was heard two years later; the fact that the detailed archival record does not extend beyond the case's filing suggests that the case was decided in favor of the United States.[18]

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[15] William Williams, Commissioner, to Secretary of the Treasury, December 11, 1902; File 51477/44; Box 36; Entry 9; RG 85; NARA I.

16 Correspondence surrounding the boundary dispute with New Jersey is contained in File 51447/44 Part 1; Box 36; Entry 9; RG 85; NARA I.

[17] "Contract, Bond, and Specification for the Construction of an Island and a Certain Gangway in New York Harbor, Near Ellis Island," April 19, 1905; File 51447/44 Part 2B; Box 36; Entry 9; RG 85; NARA I.

[18] Correspondence and documents relating to the conflict and the court case are located in File 51447/44 pt. 4; Box 36; Entry 9; RG 85; NARA I.

The completion of Island Three in 1906, containing 4.75 acres of landfill, increased the total size of Ellis Island to almost 17 acres. Wooden cribbing contained the island's fill and formed a bulkhead around the entire island. A detail of the bulkhead can be seen in a 1907 photograph of the hospital's construction (fig. 14). An overall view of this stage of Ellis Island's development (with the addition of the hospital complex on Island Three, which was completed in 1909) can be seen in a Irving Underhill photograph from 1912 (fig. 15).

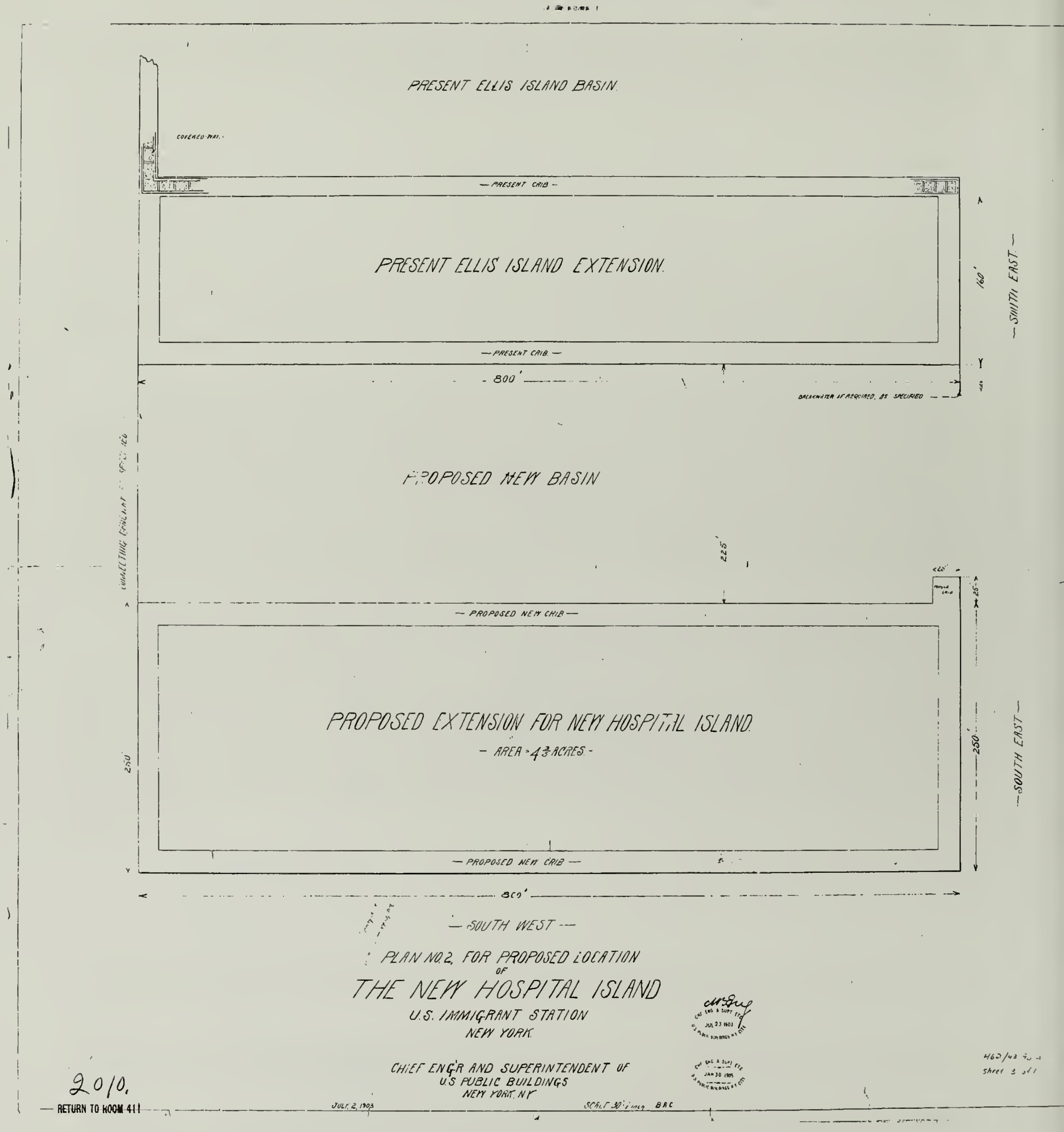

Figure 13. Layout plan for the creation of Island Three, July 2, 1903.

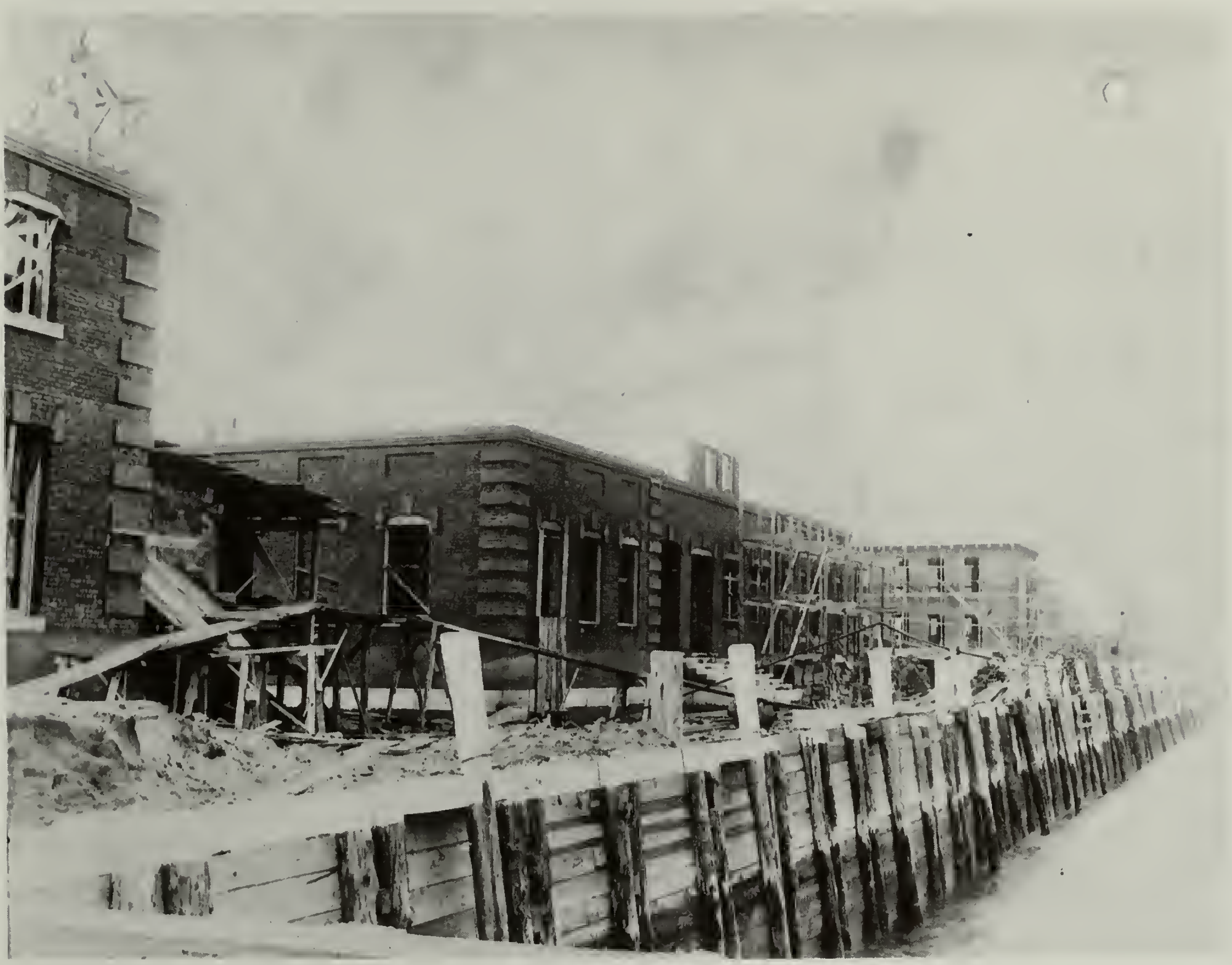

Figure 14. Island Three from the north, December 16, 1907. Note that the buildings have not yet been stuccoed, and that the negative appears to have been reversed in this print.

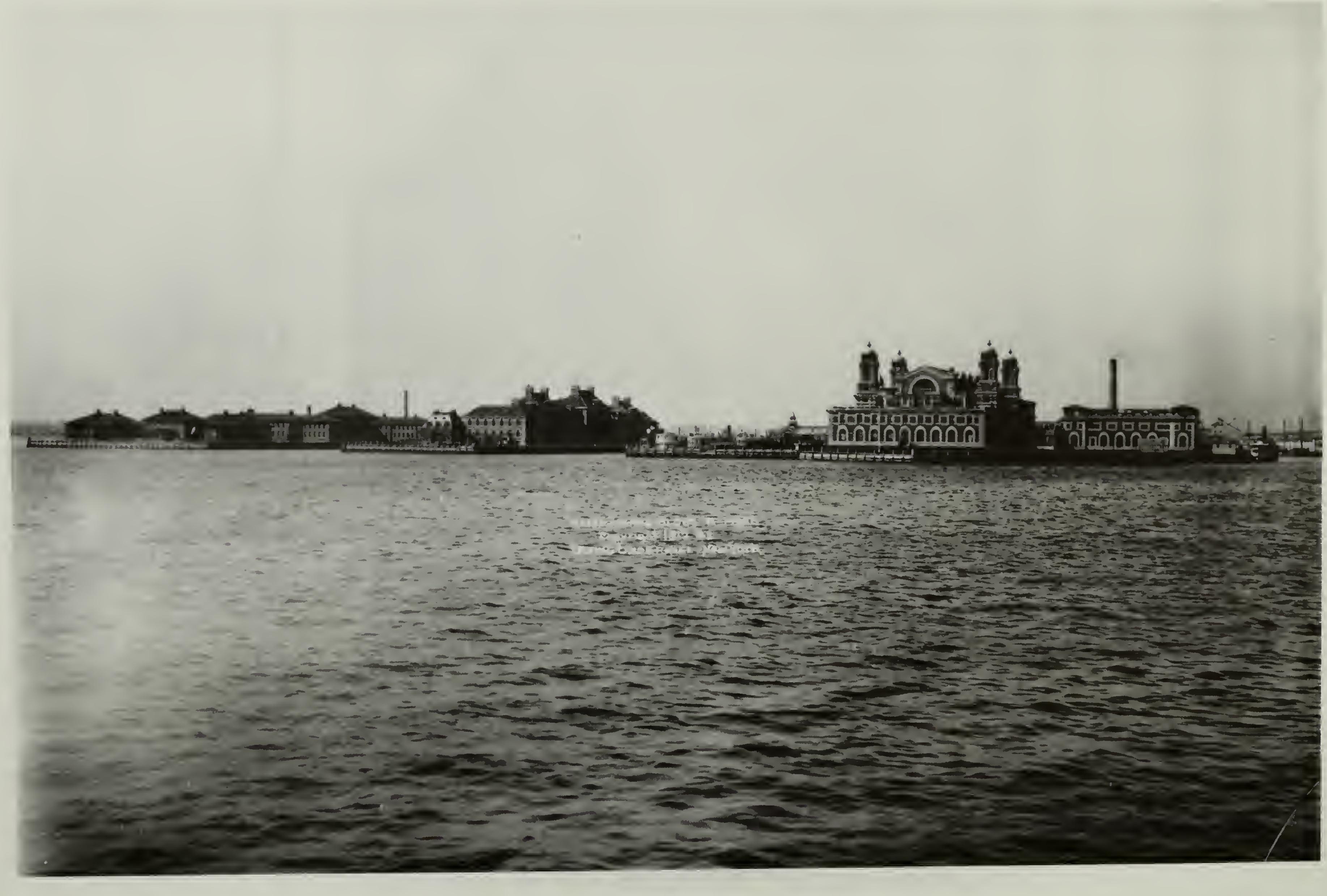

Figure 15. Ellis Island from the southeast, 1912.

PEAK IMMIGRATION PERIOD: 1907- 1920's

From 1907 through the mid- 1920's, a general increase in immigration and its support activity on Ellis Island led to an intense period of facilities improvement, spearheaded by Commissioner of Immigration William Williams. A new Baggage and Dormitory building and greenhouse were built on Island One between 1908 and 1910, a large hospital extension was completed on Island Two in 1909, and a contagious disease hospital complex on Island Three (and all of the island's landscaping) was finished the same year. Several additions to the Main Building accommodating dormitory, administrative, and medical needs, as well as a large number of interior renovations, upgraded the facilities and reflected the increased intake and expanded role of the immigration station.

It was in this context that Williams, in his 1910 funding request to Congress, asked for an initial appropriation of $150,000 towards a projected budget of almost $800,000 for the replacement of the wood crib seawall that surrounded the island with a "concrete sea wall faced with granite."[19] He stated that the 2- to 15- year- old cribwork needed to be replaced sequentially over the next five to six years, because "the life of cribwork is not over seven years," and noted that all cribwork on Island One above the water line, which included the oldest on the island, was already showing signs of decay.[20]

On March 4, 1911, Congress authorized the projected $787,170 expenditure, to be appropriated in phases.[21] Work on the seawall began in December of that year with a preliminary testing phase that consisted of test- pile driving followed by hydraulic test borings and soundings around Island One to ascertain the extent of the "marked variation in the character and depth to hard bottom."[22] The tests confirmed the variability in topography surrounding the island, suggesting that "no uniform system of construction [could] be adopted" for the entire island.[23]

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[19] William Williams, Commissioner of Immigration to the Commissioner- General, July 1, 1910; File 558; Box 55640; RG 85; NARA I.

[20] See footnote 19.

[21] Public No. 525, H.R. 32909; File 558; Box 55640; RG 85; NARA I.

[22] Albert Fry, Chief Engineer and Superintendent, to Commissioner of Immigration, December 12, 1911; File 558; Box 55640; RG 85; NARA I.

[23] "Memorandum by Mr. Fry Concerning Construction of Proposed Sea Walls Around the Three Islands of the U.S. Immigrant Station at Ellis Island," June 4, 1912; File 558; Box 55640; RG 85; NARA I.

Contract 1: North Wall along Ferry Basin, 1913-1914

The test borings confirmed that the depth of dredging required to accommodate ferry traffic in the slip would undermine a new seawall in this area if it were built on top of the original cribwork, as Albert North Fry had originally predicted. The new ferry basin seawall would instead be built in front of the cribwork, on precast concrete foundations placed in a deep trench dredged to rock bottom. The contract for dredging in front of the cribbing along the north side of the ferry slip was awarded to the Taylor Dredging Company, the same contractors that had made the test borings.[24]

Fry prepared the drawings and specifications for the first contract (fig. 29 and Appendix C), which covered the construction of the seawall from the northwest corner of the ferry basin to the edge of the projecting tongue crib at the northeast corner. The specifications were put out to bid in January 1913, and the contract was awarded the following month to the Phoenix Construction Company. The construction of this section of seawall is depicted in figure 16. After the work began, additional appropriations were made for the removal of the tongue crib at the southeast corner of the ferry basin, the extension of the seawall beyond this point, the removal of the upper portion of the old cribwork, and the filling and leveling of the 12-foot-wide gap between the old timber and new masonry walls.[25] After several delays, first for the changes in scope and then because freezing conditions in the winter of 1913 had led to mortar failure, the seawall along the north side of the ferry basin was completed in July 1914.

Contract 2: South Wall along Ferry Basin, 1915-1917

Before the first contract was completed, Albert North Fry requested that funding be appropriated to continue the masonry seawall construction along the south edge of the ferry basin. The old breakwater cribwork along this side, dating from the first island extension in 1891, was now almost 25 years old and had "very recently shown signs of distortion, due to soil washing out from beneath."[26] Congress appropriated $150,000 for this second contract on August 1, 1914, shortly after the completion of Contract 1.[27] Fry prepared the drawings and specifications for the contract (figs. 30-31 and Appendix C).

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[24] "Contract and Bond for Dredging Seawall Preliminary to building new Seawall," July 23, 1912; File 558; Box 55640; RG 85; NARA I.

[25] William Williams, Commissioner of Immigration, to Commissioner General of Immigration, April 1, 1913; File 558A; Box 55640; RG 85; NARA I. The dimensions of the gap are given in a memo in this same location, dated July 31, 1913.

[26] Letter from Fry to William Williams, July 27, 1915; File 558 E; Box 55640; Entry 9; RG 85; NARA I. See also letter from Fry to William Williams, March 24, 1913; File 558 A; Box 55640; Entry 9; RG 85; NARA I.

[27] Public no. 161, 63rd Congress, H.R. 17041; File 558 B; Box 55640; Entry 9; RG 85; NARA I.

Work got underway on this section of the seawall in August 1912, when a specification was put out for the stabilization of the easternmost 200 feet of the old cribwork.[28] Problematic since its incorporation into Island Two's construction in 1899, this part of the old breakwater had slipped into the trench dredged for the new wall along with a portion of its fill.[29] After the sheet piling stabilization had been completed, additional contracts provided for the Taylor Dredging Company to remove the slipped cribwork and to remove all *in situ* cribbing above the low water mark.[30]

In October 1915, the second contract was awarded to the Phoenix Dredging Company.[31] Delayed by congested harbor traffic and wartime labor shortages, the contract was mostly completed by November 1916.[32] The lower courses of the granite facing still required pointing, which could only be carried out during the several hours a day of low tide, and could not be worked on at all in cold weather.[33] The contract was fully completed in April 1917.[34]

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[28] "Specification for all Labor and Materials Required for Sheet Piling, etc. Behind Present Crib Work Along Northeast Face of Island No. 2"; File 558 C; Box 55640; Entry 9; RG 85; NARA I.

[29] Letter from Fry to William Williams, July 27, 1915; File 558 E; Box 55640; Entry 9; RG 85; NARA I.

[30] Letter from Acting Commissioner of Immigration Baker, to Commissioner- General of Immigration, October 25, 1915; File 558 C; Box 55640; Entry 9; RG 85; NARA I.

[31] The award of the Contract Two seawall was delayed when an aggressive contractor underbid all of the other bidders by proposing a different system of construction from that that had been used for the first two contracts; see File 28D; Box 52989; Entry 9; RG 85; NARA I for the alternate proposals from Roy H. Beattie, Inc. After much deliberation, and visits to projects that had already been completed by those contractors, Fry recommended that the contract be awarded to the Phoenix Dredging Company again because of doubts about Beattie's workmanship and his proposed concrete- block- and- wood pile method of construction; letter from Fry to Commissioner of Immigration, September 30, 1915; File 558 C; Box 55640; Entry 9; RG 85; NARA I. For the contract: Contract 2, October 14, 1915; File 558 E; Box 55640; Entry 9; RG 85; NARA I.

[32] Letter from Phoenix Construction Company to Commissioner of Immigration, September 15, 1916; File 558 D; Box 55640; Entry 9; RG 85; NARA I.

[33] Letter from Phoenix Construction Company to Commissioner of Immigration, November 29, 1916; File 558 D; Box 55640, Entry 9; RG 85; NARA I.

[34] Letter from Phoenix Construction Company to Commissioner of Immigration, April 2, 1917; File 558 D; Box 55640; Entry 9; RG 85; NARA I.

Contract 3: Wall along Southeast Sides of Islands Two and Three, across Basin between Islands Two and Three, and along Southwest Side of Island Three, 1918- 1920

Alfred Brooks Fry and the Commissioner of Immigration requested appropriations for the third phase of masonry seawall construction in May 1916, before the second contract was completed, noting that "the old crib at the easterly end of the No. 2 Island, notably at the top, is seriously rotted."[35] These plans were tabled after word came from Washington that it was "inexpedient...to submit this at the present time, given the amounts that had recently been appropriated."[36] Almost two years later, in March 1918, the third contract "to construct section of sea wall at southeast end of Island No. 2, across basin between Islands No. 2 and 3, and along southeasterly and southwesterly bulkhead lines of Island No. 3" was put out to bid, and the Phoenix Construction Company was once again the lowest bidder.[37] Because there would be no ship traffic in these shallow waters, no test borings or dredging were required, and the masonry seawall was built directly on top of the existing cribbing (see Part III, "Evolution and Technical Details," fig. 32 and Appendix C).

During construction, a gap was left in the wall bridging the space between Islands Two and Three so that available fill, taken from ship ballast and from dredging for Contract 4, could be more easily deposited between the islands. The "approximately 100,000 yards of material" required to fill this area, however, could not be obtained by these means alone.[38] The wall was built across the island gap in 1919, with the basin in a partially filled state.[39] Because there was no cribwork between the islands on which to build, this section of the wall had a different method of construction from the rest of the contract (see Part 3, "Evolution and Technical Details.")

Although ashes and clinkers were regularly added to the walled basin from coal-powered ferries throughout the 1920's, it would remain incompletely filled until its grading in 1933. This intermediate state can be seen in several photographs from the 1920's, which show different levels of fill between the islands (figs. 17- 19).[40] Due to labor problems caused by both marine strikes and the aftermath of the war, and the frequent difficulty of procuring fuel and materials, Contract 3 was not finished until June 1920.

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[35] Letter from Fry to William Williams, May 4, 1916; File 558 D; Box 55640; Entry 9; RG 85; NARA I.

[36] Letter from Alfred Hampton, acting Commissioner- General of Immigration, to William Williams, May 12, 1916; File 558 D; Box 55640; Entry 9; RG 85; NARA I.

[37] Contract 3, March 11, 1918; File 558 C; Box 55640; Entry 9; RG 85; NARA I.

[38] Letter from Byron Uhl, Assistant Commissioner, to Commissioner- General of Immigration, February 5, 1919; File 558 D; Box 55640; Entry 9; RG 85; NARA I.

[39] Letter from Fry to Acting Commissioner Baker, August 25, 1919; File 558 D; Box 55640; Entry 9; RG 85; NARA I.

[40] J. Tracy Stakley, *Cultural Landscape Report for Ellis Island, Statue of Liberty National Monument: Site History* (Brookline, MA: National Park Service, Olmsted Center for Landscape Preservation, 2003), p. 91.

Contract 4: Northeast Side of Island One, 1918- 1920

The contract for the fourth phase of seawall construction was put out to bid in October 1918, just six months after Contract 3 was signed (fig. 33 and Appendix C). This too was awarded to Phoenix. The contract covered the middle of the northeast side of Island One, off the shore from the Baggage and Dormitory Building. This section of seawall was intended for use as another docking site for ferries.

The drawing and specification describes a section of wall running 510 feet along the northwest side, turning the corner by the Baggage and Dormitory Building and proceeding southwest for 45 feet.[41] Apparently, however, only 450 feet of the seawall was constructed, ending in front of the Baggage and Dormitory Building before the wall turned the corner. This shortened length is depicted by the drawing and specification for Contract 5, which includes the corner evidently not completed in Contract 4 (see fig. A and figs. 33- 34). Although no mention of this modification exists in the surviving archival record, it may be assumed that the shortening was due to the exhaustion of the $125,000 appropriation before the specified length was reached. The budget shortfall was perhaps due to underestimated dredging costs, a circumstance that seemed to arise with many of the contracts.

The offshore location of this seawall section, 50 feet in front of the existing cribwork, was chosen because the bottom conditions adjacent to the island were shallow and rocky. By building at a greater distance from the original land mass, the engineers hoped to "avoid a considerable portion of [the] difficult and costly dredging" that had been required for the ferry basin walls of Contracts 1 and 2, at the same time increasing the size of the island when the space between the old cribwork and the new seawall was filled in at a later date.[42]

Like Contract 3, the completion of Contract 4 was delayed by labor, fuel, and material shortages caused both by marine strikes and the war. Contract 4 was finished in October 1920. After the completion of the seawall contract, fender piles were installed alongside the section, and a ramp added between the seawall and the existing wharf in front of the baggage and dormitory building.[43] An aerial photograph from 1926 shows that the area between the Contract 4 seawall and the Baggage and Dormitory Building was filled in by this time (fig. 19).

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[41] "Specification For All Labor and Materials Required to Construct Section of Sea Wall...Under Sea Wall Contract Number Four," paragraph 24, October 1918; File 558 D; Box 55640; Entry 9; RG 85; NARA I.

[42] Letter from Frederic C. Howe, Commissioner, to Commissioner- General of Immigration, September 17, 1914, p. 5; File 558 B; Box 55640; Entry 9; RG 85; NARA I.

[43] Specification: "For all Labor and Materials Required for Construction of Ramps Between Sea Wall and Baggage and Dormitory Building and Installation of a Fender Pile System," October 11, 1920; File 558 F; Box 55640; Entry 9; RG 85; NARA I.

Contract 5: Northwest Corner of Island One, 1920- 1921

Congress appropriated $175,000 for the continuation of the seawall under a fifth contract in July 1919.[44] Fry prepared drawings and specifications for dredging and wall construction in March 1920 (see fig. 34 and Appendix C). Following test borings, the specifications were put out to bid in June. This section of the seawall began where Contract 4 had left off, extending northwest an additional 85 feet, turning towards land for 25 feet, resuming its course along the northeastern side of the island for 220 more feet, turning the northwestern corner of the island, and proceeding about 215 feet along the northwest side.[45] Like the preceding seawall section, it was built significantly in front of the existing crib bulkhead on the northeast side, presumably to avoid extensive dredging of the shallow, rocky bottom in an area where there would be boat traffic.

The dredging contract for the deep- wall foundation was awarded, once again, to the Taylor Construction Company. The contract for the seawall construction, however, was awarded to Howard M. Peterson, who finally underbid the Phoenix Construction Company after having submitted unsuccessful bids for each of the previous seawall contracts. Work began on the contract in the fall of 1920, and finished sometime in 1921.[46]

This section of wall served as the output for the island's sewage lines. Before its completion, the sewer pipes had to extend through the wall to a point where the waste could be washed away by the tides (Appendix C).[47]

Work on the Seawall Stops: 1921- 1933

Upon the completion of Contract 5 in 1921, the granite- faced concrete seawall enclosed much of the island. It was intended that the masonry seawall perimeter be completed without delay; wood cribbing from as early as 1896 still formed the bulkhead at the southeast side of Island One and along most of the northwest side of the island complex. A proposed expenditure of $800,000 for the construction of a complete perimeter had been authorized by

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[44] Sundry Civil Act, HR 7343; File 558 F; Box 55640; Entry 9; RG 85; NARA I.

[45] The specification for Contract 5 states that the wall on the northwest should extend 585 feet "more or less, as the appropriation may permit" (Spec. paragraph 25), and the accompanying drawing indicates this length, thick- lined, in the plan. The drawing also, however, contains a notation (possibly a slightly later annotation?) that the contract ends after just 200 feet in the northwesterly direction, and the drawings for the next phase of seawall construction, in 1933 (see figs. 21, 32), indicate that this shorter length what was built.

[46] Letter from Byron H. Uhl, Commissioner of Immigration, to Commissioner- General of Immigration, January 11, 1921; File 558 G; Box 55640; Entry 9; RG 85; NARA I. No documentation for the exact ending date could be found, but this letter implies that work on this section was winding down.

[47] Letter from Byron H. Uhl, Commissioner of Immigration, to Commissioner- General of Immigration, January 11, 1921; File 558 G; Box 55640; Entry 9; RG 85; NARA I.

Congress in 1911, and this entire budget had not been appropriated in the first five contracts. A proposal for the completion of the seawall around the southeast point was pictured on the cover of *Scientific American* in 1919 (fig. 20), and appropriations for the completion (significantly larger, of course, than those budgeted in 1911) were requested in 1923.[48] Work would not resume on the seawall, however, for almost a decade.

Appropriations were again requested to complete the seawall in 1929 and 1932, the latter under the Department of Labor's Emergency Relief and Construction Act of 1932.[49] These requests were accompanied with urgent warnings that "certain sections [of the cribwork] are now in such bad condition that, unless action be taken in the immediate future, it is highly probable that considerable damage will be done to Government property"; that tides had washed out "a considerable quantity" of the ash fill between Islands Two and Three through the west gangway; and that the bulkheads had "rotted away."[50] Both requests were unsuccessful.[51]

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[48] Letter from Henry H. Curran, Commissioner of Immigration, to Commissioner- General of Immigration, December 17, 1923, p. 19; File 558 F; Box 55640; Entry 9; RG 85; NARA I.

[49] Letter from I.F. Nixon, Acting Commissioner- General of Immigration, September 11, 1929, and letter from Wm. N. Doan, Secretary of Labor, to Col. J. Clawson Roop, Director, Bureau of the Budget, July 28, 1932; File 558 G; Box 55640; Entry 9; RG 85; NARA I.

[50] Letter from I.F. Nixon, Acting Commissioner- General of Immigration, September 11, 1929; Entry 9; Box 55640, file 558 G; RG 85; and letter from Benjamin M. Day, Commissioner of Immigration, to Commissioner- General of Immigration, April 26, 1929; File 558 F; Box 55640; Entry 9; RG 85; NARA I.

[51] Letter from Col. J. Clawson Roop, Director, Bureau of the Budget, to Wm. N. Doan, Secretary of Labor, July 30, 1932; File 558 G; Box 55640; Entry 9; RG 85; NARA I.

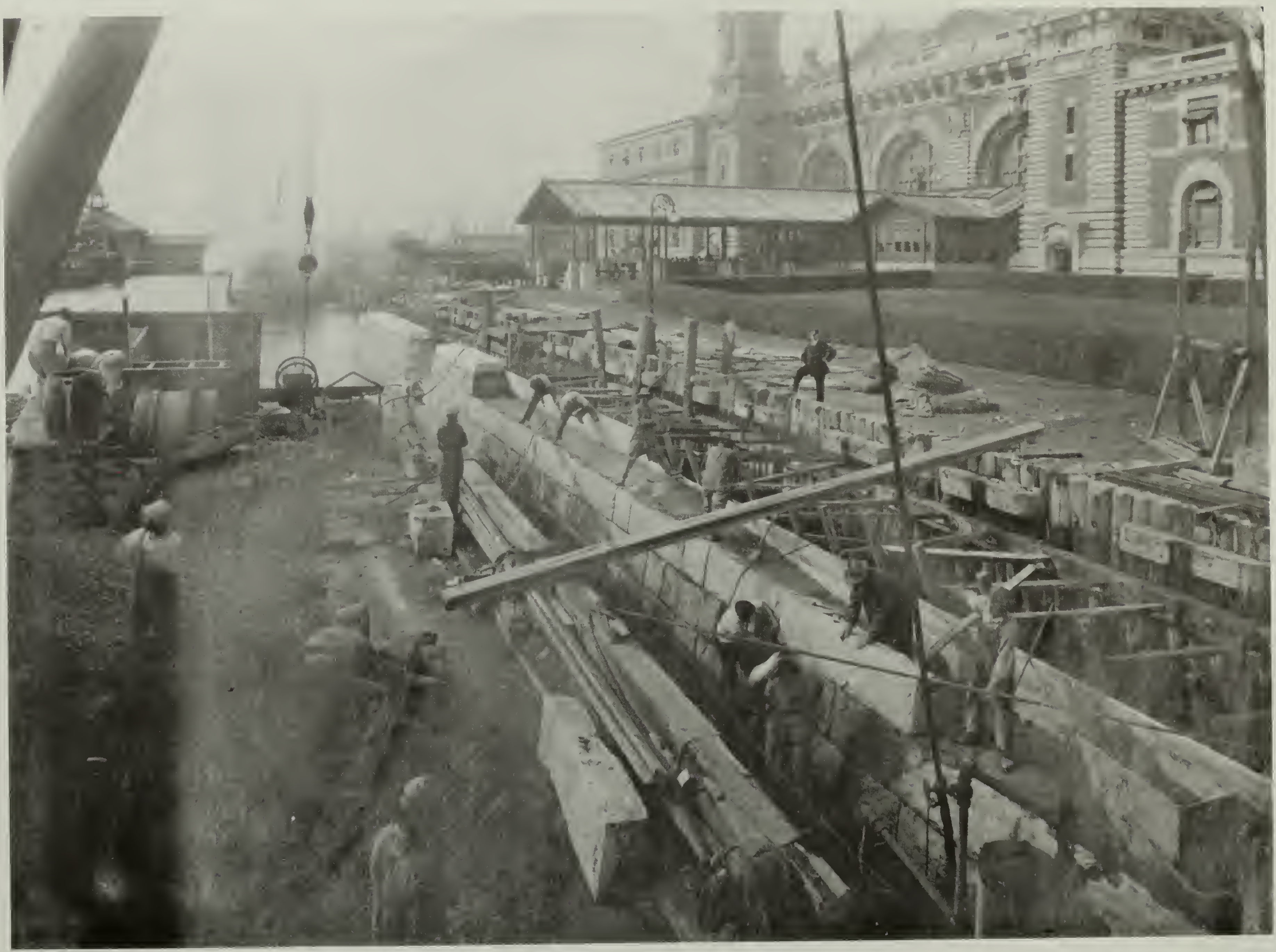


Figure 16. Construction of Contract 1 seawall, looking north, August 1913.

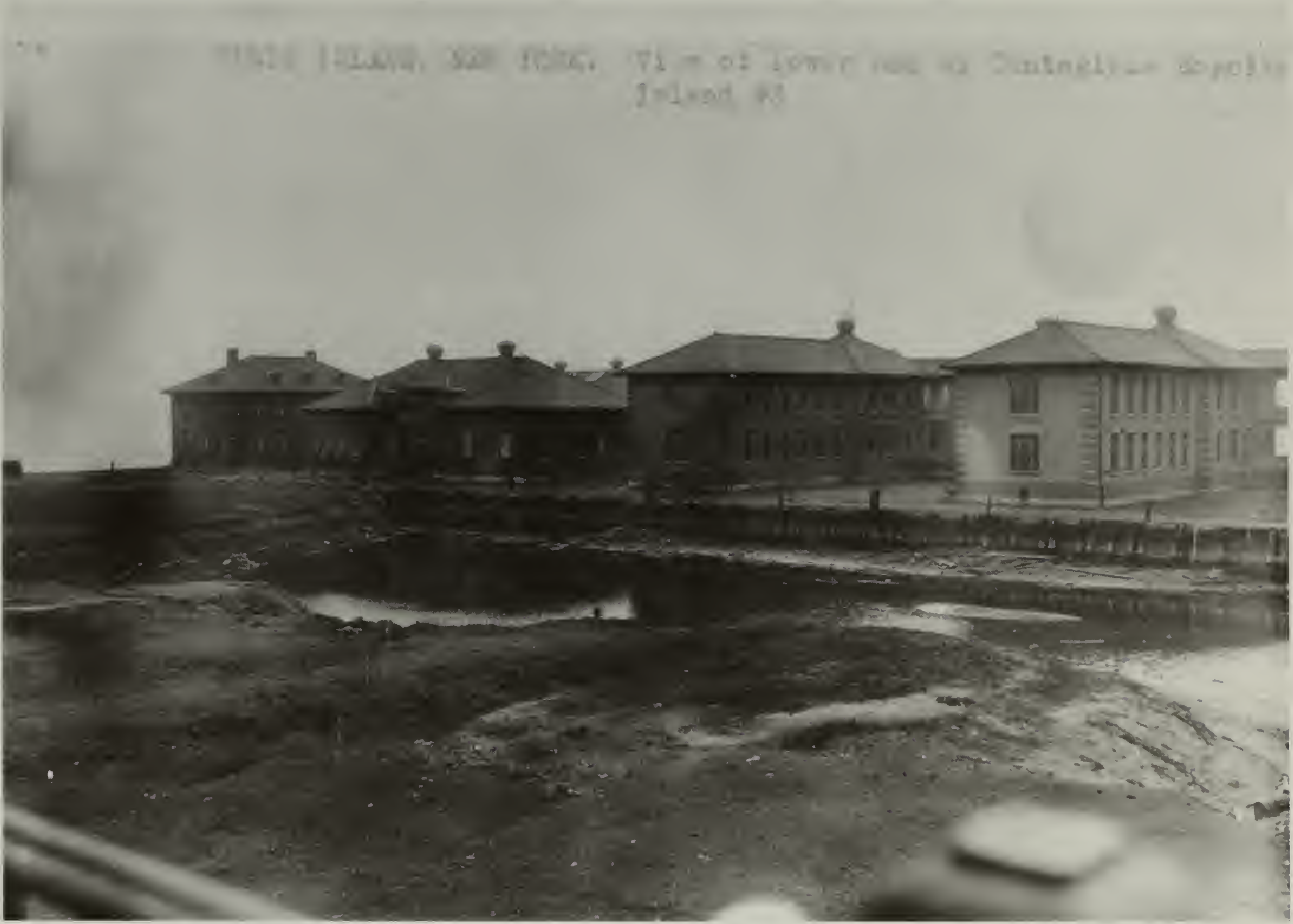

ELLIS ISLAND, NEW YORK. View of lower end of Contagious Hospital
Island #3

Figure 17. Island Three and fill between Islands Two and Three, looking south, circa 1925.

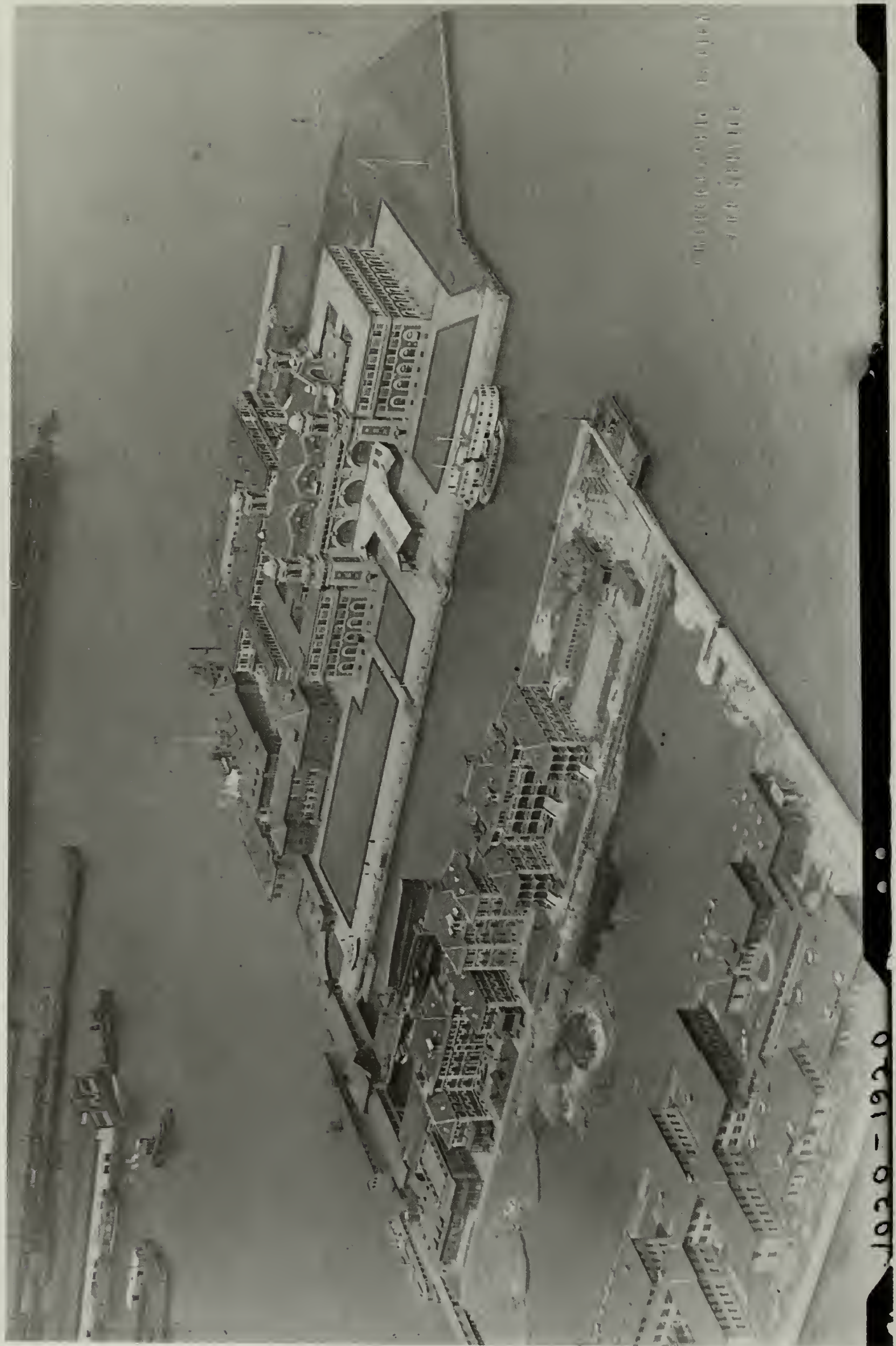


Figure 18. Aerial view of Ellis Island, 1920. Note incomplete fill between Islands Two and Three.

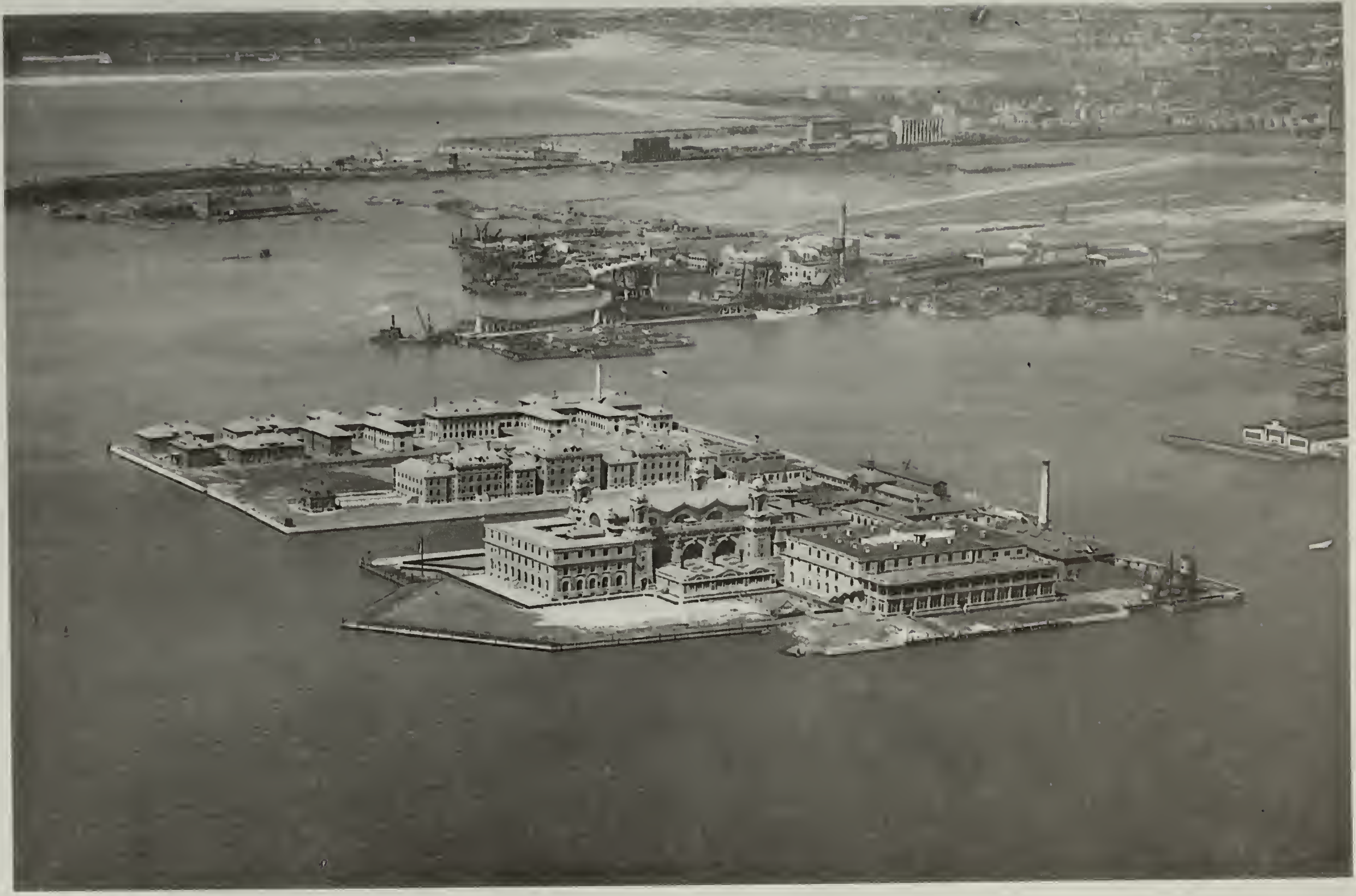
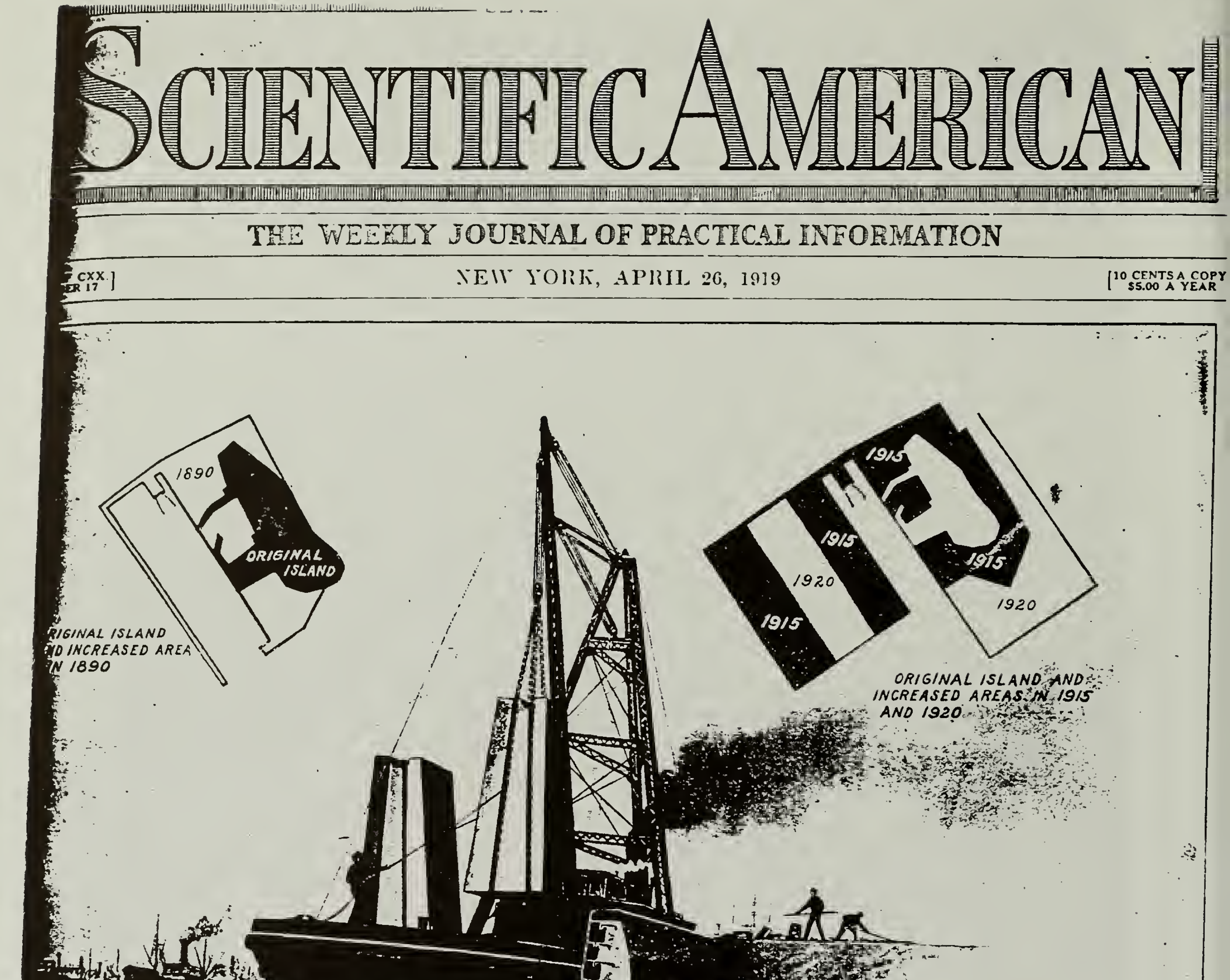


Figure 19. Aerial view of Ellis Island, 1926.



SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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NEW YORK, APRIL 26, 1919

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1890
ORIGINAL ISLAND
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ND INCREASED AREA
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ORIGINAL ISLAND AND
INCREASED AREAS IN 1915
AND 1920
MOULDED CONCRETE GRANITE FACED
CONCRETE BLOCKS
CHAIN CHANNELS
BAGS OF CONCRETE
METHOD OF PLACING CONCRETE SECTIONS OF NEW SEA WALL WITH GRANITE FACED TOP
DETAIL CONSTRUCTION OF SEA WALL ON CRIB FOUNDATION
DETAIL CONSTRUCTION OF NEW SEA WALL AND FOUNDATION

right, Scientific American Publishing Co.

Figure 20. Cover of *Scientific American,* April 26, 1919.

WPA ERA THROUGH DETENTION CENTER USE: CIRCA 1933- 1954

The construction of the masonry seawall sections necessary to complete the perimeter of the entire island was finally undertaken in 1933, under the National Recovery Act, a federal relief initiative overseen by the Federal Emergency Administration of Public Works. The seawall completion was a component of Federal Project 61 (FP 61), which included filling behind the new wall sections and grading the area between Islands Two and Three.[52] FP 61 was one of a series of Public Works projects on the island, consisting primarily of landscaping, maintenance, and improvements to existing structures. Many of the works undertaken in Federal Projects 61-64 were recommended in the 1933 Report of the Sub- Committee on Buildings, Grounds, and Physical Equipment for Ellis Island, which sought to "adapt Ellis Island to its present needs." Ellis' primary function had begun to shift towards the detention of deportees, repatriates, and those in need of hospital care.[53] Immigrants still passed through the station, but in smaller numbers than they had previously, and were kept for shorter periods of time than in the past. Previously overseen by the Bureau of Immigration, Ellis Island came under the jurisdiction of the Immigration and Naturalization Service (INS) when this bureau was merged with the Bureau of Naturalization, also within the Department of Labor, in 1933.

The original plan for the seawall at the southeast of Island One involved the construction of the seawall at a considerable distance from the bulkhead, "squaring off" the shape of the island and adding a large amount of landfill (while also, presumably, mitigating the dredging costs for the shallow, rocky waters in this area). This plan was first depicted on the cover of *Scientific American* in 1919 (fig. 20), and a similar configuration with less landfill acreage is shown in a plan from July 1933.[54] The September 1933 committee report, however, recommended that the new seawall follow the existing bulkhead line at the southeast, instead adding landfill that could be used for immigrant recreation space at the northwest of the island.[55]

In addition to the improvements to the existing facilities and grounds, the construction of two new buildings was proposed, a new fireproof ferry terminal building to replace the "old and somewhat dilapidated" one on the same site, and a new immigration building that would enable the segregation of the various classes of deportees and immigrants. The new immigration building would be sited to the northwest of the ferry building, on landfill contained by a new section of seawall (Section 2). In conjunction with the construction of the new ferry building, the northwest end of the ferry slip would also be fronted with the granite- faced masonry seawall (Section 4). (The northwest end was previously just wood piles supporting the old ferry building and a covered walkway to either side.) New sections of masonry seawall would also replace the remaining areas of wood crib seawall on the island, to the south and north of the proposed fill on the northwest side (Sections 1 and 3, respectively), and around Island One's southeast point (Section 5). The section divisions can be seen on the plan in figure 21.

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[52] "Remove 2 feet of present cinder fill between buildings of Is. No. 2 and replace with 18 inches of subsoil and 6 inches of top soil and plant with grass and shrubs," letter from Harold L. Ickes, Administrator, Federal Emergency Administration of Public Works, to the Secretary of Labor, November 18, 1933; File 330; Box 16; Entry 9; RG 79; NARA NY.

[53] "Report of the Sub- Committee on Buildings, Grounds, and Physical Equipment for Ellis Island," September 13, 1933; File 330; Box 16; Entry 9; RG 79; NARA NY.

[54] The proposed seawall extension at the southeast point of Island One is indicated on "Block Plan Showing Relative Location of Buildings Corridors Etc. on the Three Islands," July 1933. NPS Denver Service Center, Technical Information Center, STLI 43968.0009 tif.

[55] "Report of the Sub- Committee on Buildings, Grounds, and Physical Equipment for Ellis Island," September 13, 1933, p. 2; File 330; Box 16; Entry 9; RG 79; NARA NY.

The drawings and specifications for the seawall construction and the grading of the area between Islands Two and Three were prepared in November 1933, and were awarded under a single contract to A.M. Hazel, Inc. (figs. 39- 45 and Appendix D). The monthly construction photographs submitted by the contractors are preserved today.[56] The dates on the photographs show that work proceeded simultaneously on all five sections of the seawall in the sequence of construction. Preliminary work and concrete pile casting were carried out in March through May 1934 (fig. 35); pile driving in June through September (fig. 36); placement of the granite facing in October and November (fig. 37); and backfilling and grading—including that of the area between Islands Two and Three—in November and December (fig. 38). The new granite wall sections were pointed in February and March 1935.

Repointing of the pre- 1933 sections of masonry seawall was included in the original itemization for Federal Project 61 but was later eliminated; in subsequent lists of work from 1935- 36 it also received low prioritization.[57] In 1938, repointing was included as a line item in a WPA project proposal along with extensive landscaping, mechanical service upgrades, and renovations all over the island, but was one of the few items not approved for WPA implementation in 1940.[58] It was decided to perform seawall maintenance using private contracts rather than through WPA avenues because the project was one of several "requiring a large amount of skilled labor."[59] The seawall repointing was presumably contracted soon after, although no records of the work exist.

Ellis Island continued to function as an immigrant detention facility throughout the 1940s and 1950s. Its rates of immigrant detention and deportation varied during this time, dropping as immigration slowed during World War II and increasing in 1950 when the Internal Security Act prohibited the entry of members of communist and fascist organizations into the United States. In 1951, the then- outdated hospitals on Islands Two and Three were closed, and the Coast Guard established a Port Security Unit on the island, inhabiting the Island Two buildings. In 1952, the passage of the Immigration and Nationality Act broadened the grounds for exclusion and deportation of aliens, rendering the INS and Coast Guard operations on the island obsolete. Ellis Island was officially closed in November 1954, and the island was abandoned. During this time, the seawall, like all of the structures on the island, received little if any maintenance and began to fall into disrepair.

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[56] These photographs, several of which are included in this report, are located in Box 38, Folder C in the Still Pictures Division, RG 121, NARA II.

[57] Repointing is itemized in various documents in File 330; Box 16; RG 79; NARA NYC.

[58] WPA Project Proposal, November 16, 1938, and letter from W.H. Wagner to District Director, Immigration and Naturalization Service, February 17, 1939; File 903; Box 55938; RG 85; NARA I.

[59] Letter from James L. Houghteling, Commissioner, to District Director, Immigration and Naturalization Service, June 7, 1940; File 903; Box 55938; RG 85; NARA I.

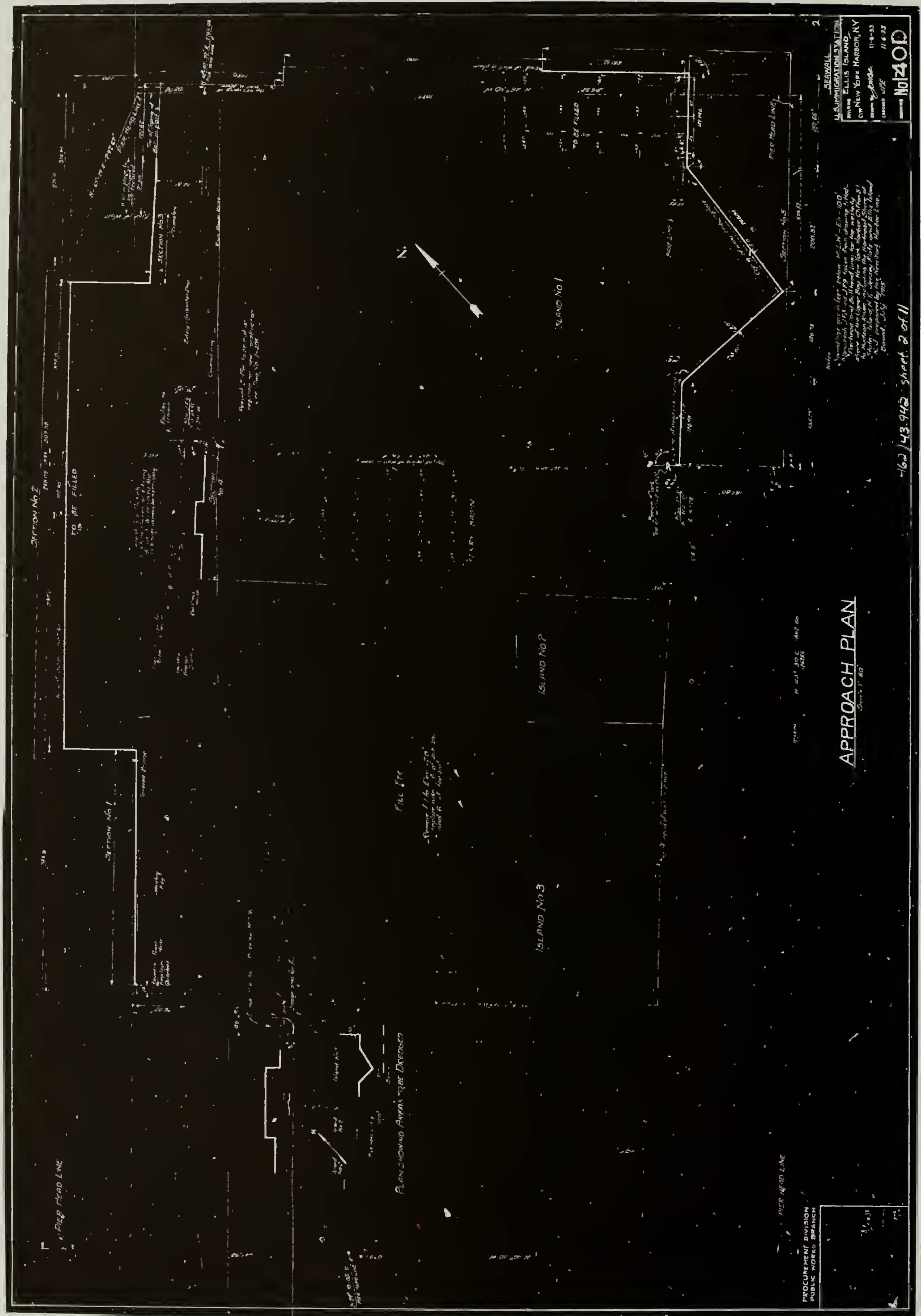

Figure 21. Plan of Ellis Island showing new sections of seawall to be constructed, November 1933.

POST IMMIGRATION PERIOD: 1954 - PRESENT

Over the next 10 years, the General Services Administration unsuccessfully offered Ellis Island to federal, state, and local government agencies; nonprofit agencies; and, amidst public outcry, to private developers. Numerous plans for reuse in all sectors were proposed, examined, and ultimately rejected until 1964, when a study examined the feasibility of adding the site to the National Park Service. In 1965, Ellis Island was officially incorporated into the National Park system when President Lyndon B. Johnson signed Proclamation 3656, adding Ellis Island to the existing Statue of Liberty National Monument. Twenty- five years of extensive planning, fundraising, and eventual rehabilitation would follow before Ellis Island was officially opened to the public as the Ellis Island Immigration Museum in 1990.

During the years of abandonment and the first two decades of National Park Service planning, the seawall—like all of the island's structures—continued to deteriorate. An account in the *New York Times* from 1976 noted that the buildings were dilapidated, the grounds were overgrown, and "the encircling seawall is broken and crumbling in spots."[60] A contemporary magazine article stated that the overall appearance of the island was "reduced by a crumbling seawall gradually sliding into the bay."[61]

It was in the context of planning for Ellis Island's rehabilitation as a NPS site that the seawall received its first comprehensive attention. A 1976 report was commissioned from the engineering firm URS/Madigan- Praeger, Inc. (Appendix E). This report documented the condition of the seawall (including the loss of granite facing stones; the settlement, displacement, and partial collapse of wall sections; and the formation of sinkholes behind the wall), discussed the causes of deterioration, and made recommendations for its repair.[62]

In 1987, in conjunction with the rehabilitation work on the main building, a program of seawall repair was executed. Open joints and voids in the concrete elements were grouted, loose granite facing stones were reset, and the granite joints were repointed. Riprap was replaced where it had washed out from the wooden piles and platforms of the masonry wall foundations. In addition to the seawall work, a new wood fender system was installed along the ferry basin, and new concrete walks were poured around the perimeter of Island One.

By 1997, the stabilization work carried out in 1987 was considered to have failed along the south side of the ferry basin. Mortar had washed out from the joints, wall displacement continued, and granite facing blocks fell from their positions. The park's maintenance crew carried out a second campaign of grouting, block repositioning, and repointing.

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[60] Robert D. McFadden, *The New York Times,* May 28, 1976.

[61] Lee Dennis, *Historic Preservation,* April- June 1978, pp. 10- 19.

[62] Although archival research was apparently not a component of the 1976 investigation, the field surveys (many of which were conducted by divers) reveal that the methods of construction are the same as those that were specified in the drawings and contract documents. This suggests that the original documents, discussed subsequently in Part III, "Physical Evolution and Technical Details," give an accurate picture of the seawall "as built."

These measures have been equally unsuccessful in stabilizing the seawall. Today, mortar joints continue to erode, and granite facing blocks continue to fall into the harbor, each at a rate too rapid for periodic maintenance to prevent. Additionally, the wooden relieving platforms, piles, and cribs—not addressed in the 1987 repair beyond the replacement of their riprap—have decayed and are being attacked by marine borers. Sinkholes continue to develop around the inside perimeter of the seawall, indicating a continued loss of fill through the wall. These conditions prompted the commissioning of two condition reports in 2000 and 2001.[63] The reports provided the background for the present Historic Seawall Rehabilitation project, the pre- design phase of which this historic structure report is a component.

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[63] *Condition Survey, Ellis Island Ferry Slip*, Simpson & Brown, Inc., for Mueser Rutledge Consulting Engineers, February 2000; and "Ellis Island National Historic Site, Ferry Building Substructure & Seawall Inspection," J.T. Cleary, Inc., February 2001.

PART III.

PHYSICAL EVOLUTION AND TECHNICAL DETAILS

FIRST IMMIGRATION STATION: 1890- 1897

Specifications for the 1890 Island One extension are reproduced in Appendix A. With the exception of one plan (fig. 3), the drawings for this phase of cribwork construction and fill were reportedly lost with the immigration records in the 1897 fire.[1] It is possible that this was the fate of the specifications for the 1895 extensions as well, another void in the archival record. Specifications for the breakwater crib forming the south of the ferry basin, constructed in 1891 in a separate contract and with the same contractor as that of the other cribwork, also do not exist.[2]

The main crib along the north of the ferry basin was 22 feet wide on the bottom and 18 feet wide on top, sunk 12 feet deep below mean low water into channels dredged for this purpose. The cribs around the northwest and southeast sides of the island were not as wide as the main crib; their exact dimensions are unknown.[3]

Below mean low water, the cribs were floored with abutting logs that rested on sills, and were built up with long yellow- pine logs (longitudinal members and transverse braces), lap-joined and secured with long pieces of iron hardware—either "dock spikes" or threaded bolts, depending on the joint. From mean low water to the height of the grade (about 5 feet above mean high water), the crib was built of courses of 12- inch- square, yellow- pine timbers in alternate longitudinal and transverse arrangements. The longitudinal timbers were lap- joined, and the transverse braces were dovetailed into the face timbers and secured with iron dock spikes. The face of this 1890 construction can be seen along the main crib in front of the old main building (fig. 4; this crib would be damaged and a new facing constructed in the 1897 fire), on the inner part of the breakwater (fig. 11, here incorporated into Island Two), and around the southeast point of Island One, where it would remain until 1930 (fig. 19).

The old crib comprising the "hook" of the old jetty, probably dating from the jetty's 1870 extension (see fig. 2), was dismantled to mean low water, and the lower portions were incorporated into the new main crib construction. A new upper crib was built along this older section and faced with close piling (fig. 4). The piling was probably intended to give the older crib face the same water- tightness as the tightly joined, newly constructed part.

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[1] Reference to the loss of construction records in the fire is given in Fry to William Williams, March 24, 1913; File 558A; Box 55640; Entry 9; Record Group (RG) 85; NARA I.

[2] No construction documents for the breakwater were found, and were in fact missing by the time of Island Two's construction in 1898 (if they ever existed); see note 10.

[3] The dimensions of the subsidiary cribs are not given in the specification. The sizes indicated in the 1890 scale drawing (fig. 3)—12 feet wide for the north and northwest cribs, and 20 feet wide for the southeast crib—do not correspond in scale to the width of the main crib, stated in the specification to be 22 feet wide at the bottom and 18 feet wide at the top. That the side cribs are in fact smaller is confirmed in a letter from Thomas Casey to the Supervising Architect, Treasury Department, November 3, 1890; Box 441; Entry 25; RG 121; NARA II.

The appearance of these faced cribs differed markedly from those of the open cribs that formed the outer face of the breakwater on the south side (fig. 5), the southeast side of the island,[4] and the north side of the island.[5] These subsidiary bulkhead cribs were constructed from the low water mark to the top with round spruce logs stacked in alternate directions, without the sawn, dovetailed timber facing of the other cribs.

The entire volume of all of the lower cribs, from the floor to one foot within mean low water (where the upper cribs began), was filled with riprap with diameter of 18 inches and less. Seven hundred and fifty additional tons of riprap was placed behind the new cribwork along the south side and east end, to resist the pressure of the earth fill that would be deposited there.

The fill between the new cribwork and the original island shores consisted primarily of material from dredging operations required to deepen the approach to the island and to prepare for the cribwork foundation. It is possible that material from the demolition of the Fort Gibson structures that were not rehabilitated—including the parapet, gun platform, and fort walls—was also used.[6] It may be assumed that portions of old timber piles and cribwork associated with the 1870 dock structures were simply left in place if they were not in the line of dredging (fig. 3), or if (as with the jetty face) they were not incorporated into the new crib. The area was to be finished with 3 feet of clean sand or loam. The fill material in the 1895- 1897 additions at the northeast and southeast sides of the island consisted of cinder waste in addition to the dredged material, probably from the island's recently built coal- fueled power plant and the coal- fired ferries.[7]

The Island One cribwork extensions were beset with structural problems even before the 1897 fire. In a register of letters received by the Supervising Architect of the Public Building Service, there is a reference to a "Dangerous Condition of Seawall" as early as 1895 (the letter that this entry refers to, however, could not be found).[8] After the fire, in conjunction with describing the severely damaged part of the cribwork along the north of the ferry basin requiring immediate attention, James Low noted that he examined the entire perimeter of the island cribwork with Fry and that:

> The greater part of this work requires repair; as originally constructed it was work of an inferior character, evidently planned with a view to the greatest economy in expenditure at the time, but its present condition shows clearly that in such work permanency can only be secured by thoroughly good construction, even though it should be expensive....

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[4] The open crib along the southeast of the island can be seen in an 1892- 1897 photograph from the New York Historical Society geographical file, catalog number 75820.

[5] "Specification for Building Cribs for the United States Government at Ellis Island," p. 8; Box 601; Entry 8; RG 121; NARA II.

[6] John F. Pousson, *An Overview and Assessment of Archeological Resources on Ellis Island, Statue of Liberty National Monument* (Rockville, MD: U.S. Department of the Interior, National Park Service, Denver Service Center, Eastern Team, 1986), p. 92.

[7] Pousson, p. 93.

[8] "Immigration Bureau," September 21, 1895, Letters Received, Office of the Supervising Architect, Treasury Department; Volume 35; Entry 25; RG 121; NARA II.

> The old crib having been made of round instead of square timber has allowed the filling to wash out.[9]

The only records of repair to the cribs that exist are ca.- 1897 details and a plan of the island describing repairs to the tongue crib at the southeast of the island.[10] The plan also makes note of the "recently repaired [main] crib" to its west. Later photographs of Island One, in which the original dovetailed crib exterior (fig. 4) is replaced by close pile facing (figs. 9- 10), show that the main crib was indeed repaired. No records exist of the work, however, to indicate how much of the old crib structure (some of it dating to 1870) was retained.

James Low, a technical advisor to the Supervising Architect, noted during the construction of Island Two in 1898 that the breakwater was less substantially constructed than the other cribs from that period, and speculated that the crib had been and sunk without dredging.[11] Fry made these same observations some 15 years later, during the construction of the masonry seawall around Island Two.[12] The relative instability of the breakwater, a feature requiring less structural stability than a crib used for an earth- retaining bulkhead, led to frequent structural problems along this side. These problems began with the breakwater's 1897 incorporation into the cribwork of Island Two, and are discussed in the following section.

SECOND IMMIGRANT STATION (ISLAND TWO): 1897- 1898

The only construction document that exists from the second major phase of crib construction is a plan showing the layout of the new cribwork (fig. 8). It may be assumed, however, that the method of crib construction and filling was nearly identical to that of Island Three, which would be constructed in 1905- 1906. In a letter preceding the construction of Island Three, Alfred North Fry stated that "The method of forming the proposed additional island will correspond to that used by me in building the three- acre addition...completed in the winter of 1898- 1899."[13] The specifications and drawings for Island Three are discussed in the following section.

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[9] James Low, Chief, Technical Division, to the Supervising Architect, Treasury Dept.; Box 442; Entry 26; RG 121; NARA II.

[10] NPS Denver Service Center, Technical Information Center files, STLI 43960.0009 (plan) and 43960.0008 (details). These drawings are not reproduced here because the tongue crib was removed in 1913.

[11] James P. Low, Chief, Technical Division, to the Supervising Architect, October 10, 1898; Box 442; Entry 26; RG 121; NARA II.

[12] Letter from Fry to William Williams, March 24, 1913; File 558A ; Box 55640; Entry 9; RG 85; NARA I.

[13] Alfred North Fry to William Williams, October 28, 1902; quoted in William Williams to the Secretary of the Treasury, December 11, 1902; Box 36, 51447/44; Entry 9; RG 85; NARA I.

In addition to the use of earth and stone from the dredging, some of the fire debris from Island One was used in the fill. Fry had been instructed during the cleanup of the island "to include the breaking down of all the old building walls in the island damaged more or less by fire, and to provide for their use in the cribwork, ballast, or filling, in the enlargement of the island."[14]

The existing crib breakwater at the southwest side of the ferry basin, now over eight years old, was incorporated into the structure of the island's cribwork, presumably as a cost-saving measure, to form the northeast side of the island (fig. 11). Because the ca.- 1890 crib had not been constructed to function as a retaining wall, pressure exerted by the new fill along the old crib caused some of the fill to wash out and the old crib to bulge into the basin.[15] Pending an additional appropriation of funds to stabilize the crib, the contractor was instructed to omit the fill immediately along the back of the crib, sloping it down to meet the crib's base (fig. 22).[16] Although a proposal and cost estimate were subsequently prepared for the stabilization of the crib using oak anchor and sheet piles, there is no evidence that these measures were carried out as described.[17] Stabilization using close- driven piles in front of the crib was attempted sometime between 1901 and 1907, probably in conjunction with the construction of Island Three (fig. 23; compare bulkhead construction to that of fig. 11). This did not prove to be a long- term solution, however; when a masonry seawall was constructed in front of the cribbing in 1913, similar problems with the crib's structure necessitated additional stabilization.[18]

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[14] Kemper, Acting Supervising Architect, to Alfred North Fry, September 28, 1897; File 1069; Box 605; Entry 8; RG 121; NARA II.

[15] J.P. Low, Chief, Technical Division, to the Supervising Architect, Treasury Department, October 10, 1898; Box 442; Entry 26; RG 121; NARA II.

[16] See footnote 15.

[17] Alfred North Fry to Supervising Architect, Treasury Department, November 5, 1898; Box 442; Entry 26; RG 121; NARA II.

[18] Letter from Fry to William Williams, March 24, 1913; File 558A; Box 55640; Entry 9; RG 85; NARA I. Also letter from Fry to William Williams, March 27, 1915; File 558E; Box 55640; Entry 9; RG 85; NARA I.

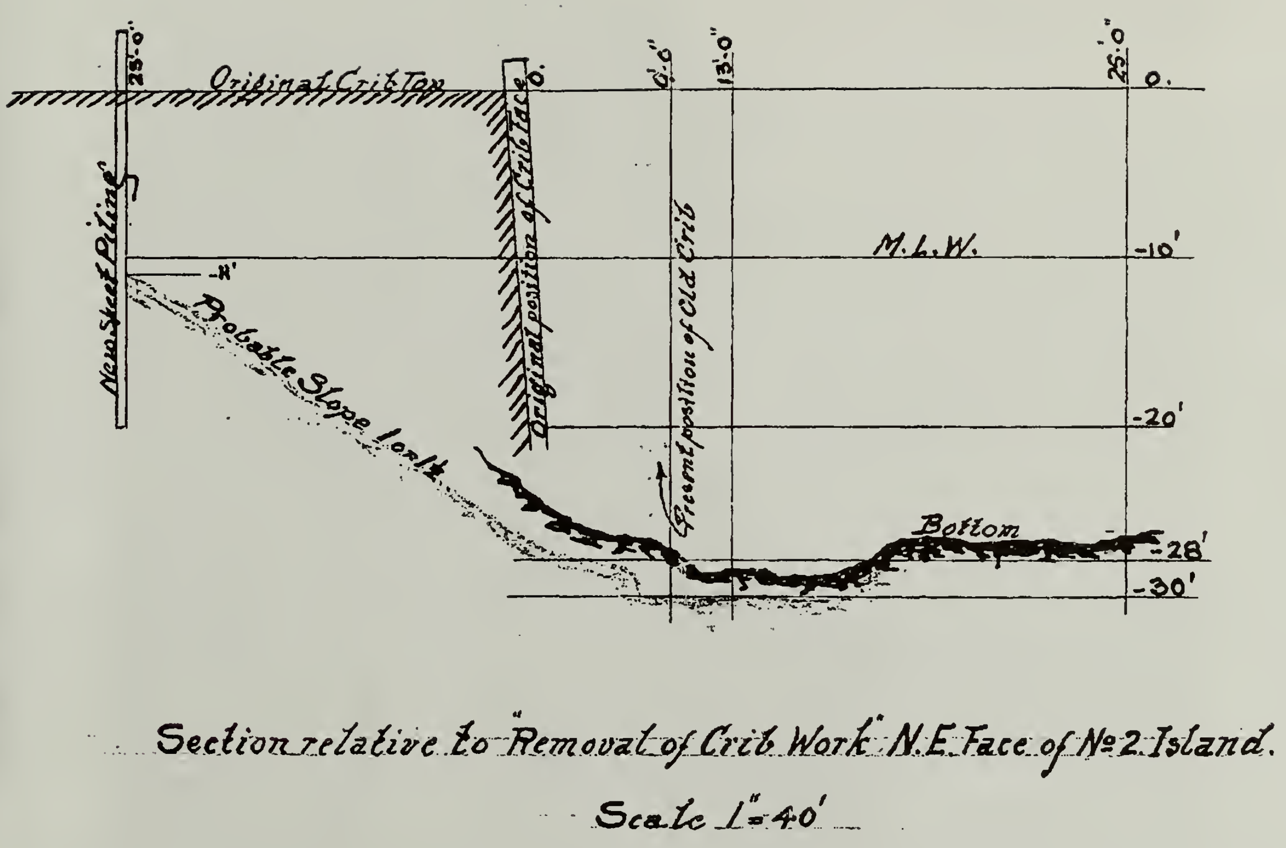
25'0"
Original Crib Top
0.
0'0"
13'0"
25'0"
0.
New Steel Piling
Original position of Crib Face
Present position of Old Crib
M.L.W.
-10'
-11'
Probable Slope 1 on 1½
-20'
Bottom
-28'
-30'
Section relative to "Removal of Crib Work" N.E. Face of No 2 Island.
Scale 1" = 40'

Figure 22. Sketch of modification made to the northeast side of Island Two during construction, 1898.

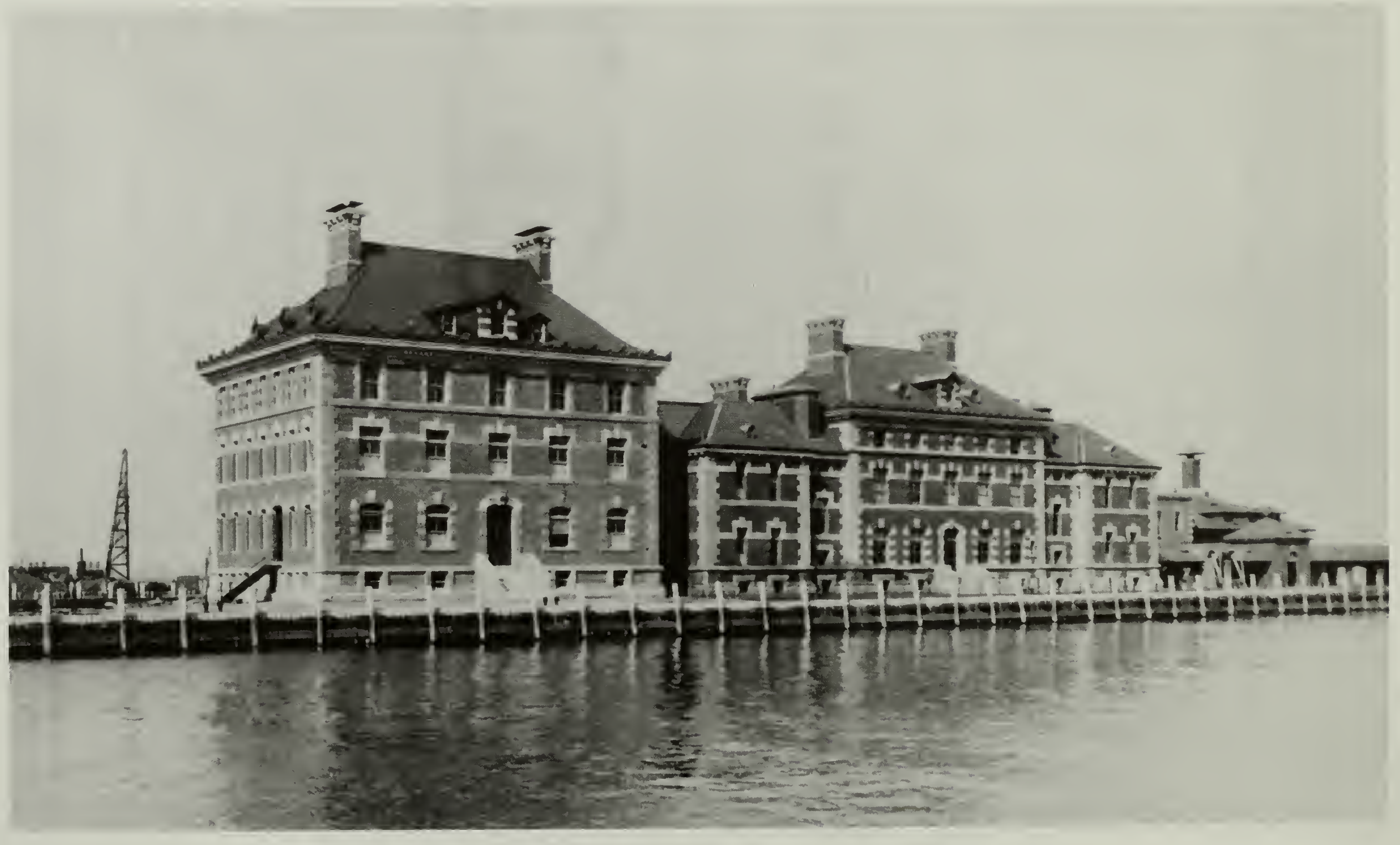

Figure 23. View of Island Two from Island One, 1907.

ISLAND THREE: 1902- 1906

Specifications for the construction of Island Three are reproduced in Appendix B; the accompanying drawings are reproduced in figures 24- 25.

The cribs were placed as shown in the plan of the island, in a layout measuring 250 by 800 feet (fig. 13). Judging by a 1912 photograph (fig. 15), the tongue crib at the southeast side of the newly created basin does not appear to have been built. The cribs were 20 feet wide at the top, of varying widths on the bottom, and were 27 feet from top to bottom. As shown in the section in figure 24, the crib had a batter of 2.5 inches to the foot below mean low water, and a batter of one inch to the foot above high water. The crib rear was vertical. Construction details for the gangway connecting Island Three to Island Two, constructed under the same contract, are given in the drawing reproduced in figure 25.

Spruce, pine, or cypress wood was specified for the lower crib; it is not known which was used. The first course of the crib was constructed of five evenly spaced round logs, followed by a course of logs placed transversely at eight- foot intervals. The lower crib was built up with the alternating longitudinal and transverse courses, half- lap joined and connected with iron spikes. For the two long- side cribs, alternate transverse logs on top of the second course of longitudinal logs were closely floored with logs to form a series of floored bays to receive riprap as ballast (see plan, fig. 24). For the shorter end cribs, the entire bottom of the crib was floored, and all bays received riprap. After the cribs were filled and sunk in place, the unfloored bays in the side cribs were filled with riprap as well, which was allowed to sink to the harbor bottom. The specifications stated that in addition to stone, old brickwork (presumably from the island) could also be used for riprap, as long as it was not fire- damaged.

The upper crib extended from mean low water to grade height. Its face consisted of longitudinal, closely abutting, sawn yellow pine timbers measuring 12 inches square, tied into round transverse logs (again, spaced at 8- foot intervals) at alternate courses with dovetail joints and iron spikes (see upper left detail, fig. 24). Four evenly spaced round longitudinal logs backed the square facing logs for each course, in a similar fashion to the lower crib. The longitudinal logs were joined to the transverse logs with half- lap joins and iron spikes.

The upper cribs were finished with the following: double vertical fenders, one placed to each side of the exposed ends of the dovetailed ties in the facing timbers; backing logs on top of the facing timber that ran the length of the cribs; mooring posts at 50- foot intervals along the cribs; and fender piles at each of the crib corners. These features of the bulkhead can be seen in a construction photograph of the hospital buildings from 1908 (fig. 14).

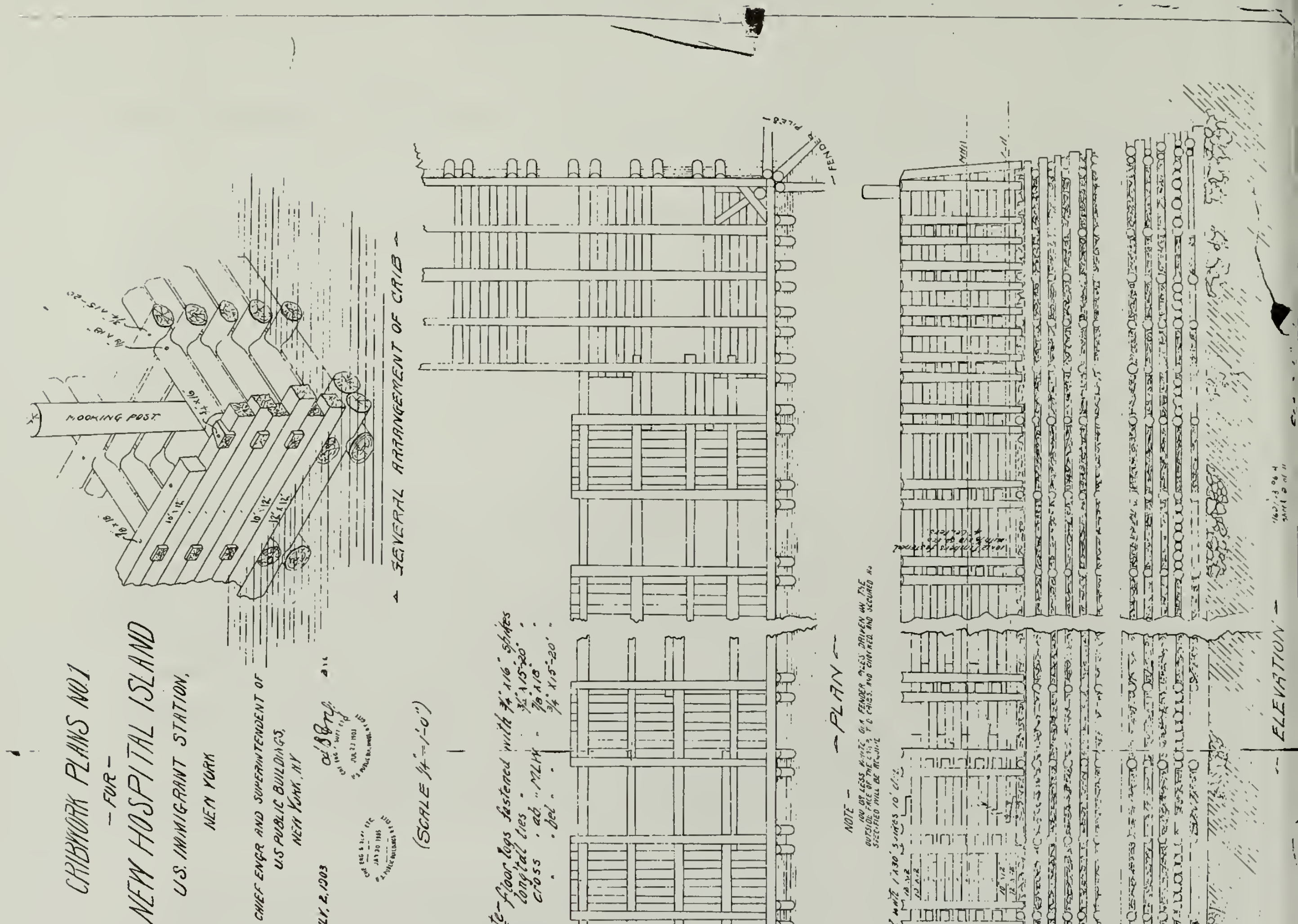

Figure 24. Construction details for Island Three cribwork, July 2, 1903.

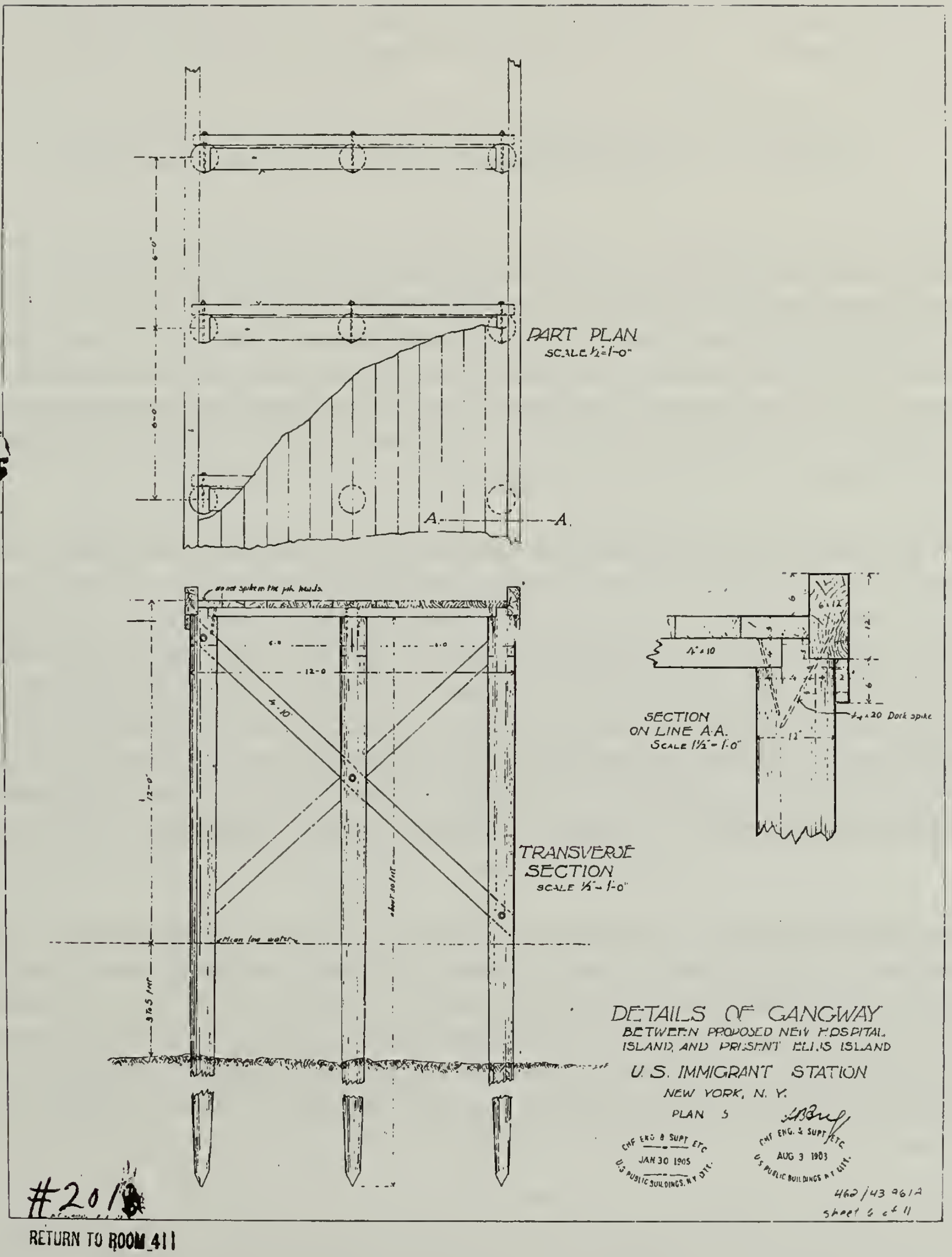

Figure 25. Construction details for gangway connecting Islands Two and Three.

REPLACEMENT OF WOOD CRIB SEAWALL WITH MASONRY: 1913- 1921

Specifications for each of the five phases of granite- faced concrete seawall are reproduced in Appendix C. The accompanying drawings are reproduced in figures 29- 34.

Contract 1: North Wall along Ferry Basin, 1913- 1914

The first section of masonry seawall, built along the north side of the ferry basin in 1913- 1914, consisted of a single type of wall construction—a deep wall on a concrete bag- work foundation (fig. 29). The foundation for the wall, laid in a trench about 15 feet wide and dredged to solid bottom (about 30 feet down), consisted of a dry mixture of one part portland cement, two parts sand, and three parts crushed stone, placed in jute bags and laid by divers in three courses. On top of this, a leveling course (with equal parts portland cement and aggregate) was poured in situ between steel railroad rails to provide a true, level base for the wall.[19]

The massive concrete blocks (17 feet high with an 8- foot- wide base) that formed the body of the wall below mean low water were precast on land in a single pour using steel forms (fig. 26). The concrete mix used was one part portland, 2.5 parts sand, and 5 parts crushed stone, which was apparently too stiff; the subsequent four contracts would use a 1- 2- 4 mixture for the same purpose. After curing, the blocks were hand- finishing to obtain a more impermeable surface, and "seasoned" in the open air for 30 days. They were then lowered onto their bag-work foundation using cranes on floating platforms whose chains were attached via grooves that had been cast into the blocks (fig. 27). Once the blocks had been set in place, dry bags of concrete were rammed into chain grooves in adjacent blocks, forming a keyed joint between the blocks.

The upper 11 feet of the wall that extended above the water line at mean low water consisted of cast- in- place, granite- faced concrete. The rock- hammered granite facing blocks, laid in courses with alternating headers and stretchers, formed the front form for the concrete; tongue- and- groove boards were used for the removable back formwork. Each granite course was laid on bedding mortar consisting of one part cement and three parts sand (the first course laid at lowest tide); this mixture was also used to point the wall after its completion. Iron ties in the top of each stone secured the granite facing to the concrete that was poured behind.[20] The concrete was poured in phases as the granite facing was built up. The concrete mixture used was the same as that for the below- water blocks. The specifications stated that no more than two granite courses be set in advance of a pour; that this sequence was followed is suggested by one of the contractor's photographs (fig. 16). Bush- hammered capstones topped the masonry wall, which was surmounted by a backing log and iron mooring bollards, the latter which were removed from the wood crib wall and reset.

---

[19] The use of rails to facilitate leveling is not included in the specification; it was a modification that the Phoenix Construction Company proposed upon submitting their bid (letter from Alfred North Fry to William Williams, February 5, 1913; File 558A; Box 55640; Entry 9; RG 85; NARA I). This modification was subsequently incorporated into the specifications for Contracts 2 through 5.

[20] The drawing and specifications for this contract also describe a system of facing- block reinforcement whereby iron wedges driven in Lewis holes (wedge- shaped cuttings) in the back center of each block held an iron tie that extended to the back of the wooden formwork. It is not known if this technique was actually used for this contract, since this detail was excluded from the remaining four contracts that just had the iron ties in the top of the blocks extending into the concrete mass.

This upper- wall construction technique was used at least in part for all five seawall contracts, even when differing bottom depths and conditions necessitated the various foundation configurations that will be discussed subsequently.

The concrete and granite wall was built in front of the existing cribwork. The drawings show a recommended distance of 9 feet between wall and crib at the top, tapering to about 3 feet at the bottom (fig. 29, upper right); in the construction photograph, however, the distance appears slightly greater (fig. 16). Although Fry had recommended that the space between the old and new walls be filled with a solid material such as gravel, ash (a readily available waste product from the Power House, and from the coal- fired island ferry) was instead used as a cost- cutting measure.[21]

Contract 2: South Wall along Ferry Basin, 1915- 1917

Before construction of the masonry wall, between 250 and 650 linear feet of white- pine sheet piling was driven behind the cribbing at the east end, which had slipped into the dredged trench.[22] Steel was first proposed for this purpose, but a great cost increase by the time the contract went out to bid (presumably due to production relating to World War I mobilization) made this prohibitive.[23] The pine piles were to measure 4 by 8 inches and approximately 30 feet long. They were to be driven to solid bottom by a steam hammer, set into concrete anchors, and secured along the top by a piece of pine whaling and anchor rods.

The second section of masonry seawall, built along the south side of the ferry basin in 1914- 1915, utilized several types of wall construction (Appendix C and fig. 30). The entire wall except for the westernmost end by the ferry slip was deep- wall construction. This was either one of the two types used in Contract 1. One type consisted of a bag- work foundation, precast underwater blocks, and a granite- faced upper wall. The other type was used where the bottom was deemed inadequate to carry a load- bearing wall of the first type. It was similar, but used a wood-pile and mass-concrete foundation instead of the bag-work as a foundation for the underwater blocks. The drawing does not specify exactly where along the wall that pile foundations were to be used, but the borings profile (fig. 30, lower left) shows about 50 percent of the side to not have attainable rock bottom (comprising about 400 feet of the 760 feet total estimated by the specification as requiring this type of construction). It may be assumed that these are the areas where pile foundations were used.

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[21] Letter from Francis Belkamp, Secretary, Phoenix Construction Company, to Byron H. Uhl, Acting Commissioner of Immigration, November 24, 1913; File 558; Box 55640; Entry 9; RG 85; NARA I. Also letter from Fry to Commissioner of Immigration, September 30, 1915; File 558C; Box 55640; Entry 9; RG 85; NARA I.

[22] "Specification for all labor required for sheet Piling, etc. behind present crib work along northeast face of Island no. 2," August 12, 1915; File 558C; Box 55640; Entry 9; RG 85; NARA I.

[23] "Specification for all labor required for sheet Piling, etc. behind present crib work along northeast face of Island no. 2," August 12, 1915; File 558C; Box 55640; Entry 9; RG 85; NARA I. Also letter from Fry to William Williams, July 27, 1915; File 558E; Box 55640; Entry 9; RG 85; NARA I.

Piles for these foundations were specified to be pine, about 50 feet in length, and driven to refusal. After confirming that these were in the correct position, mass concrete (1 part cement to 2 parts sand to 3 parts crushed stone) would be deposited around the pile tops emerging from the bottom to within 1-2 inches from the pile tops; a concrete "mattress," enclosed in burlap and a wood frame, would then be placed on the pile tops as a foundation for the underwater blocks, and the blocks immediately after. Construction of the upper wall would then proceed as for the deep wall on bag-work foundations.

The other type of construction used for Contract 2 was that of a shallow wall on piles, at the westerly 100 to 150 feet of the wall beside the ferry dock. This area was extremely shallow, and deep water (and hence dredging and deep construction) was not required for ferry passage. In this type of construction, piles were driven as for the deep wall on piles, but emerged higher above the bottom. A wood platform was then framed for the top of the piles, and riprap inserted to fill in the space between the pile platform, piles, and cribwork (fig. 31). The platform was completed with a planked floor, and the upper wall was built on top of it. In this method, no underwater precast blocks were used. The shallow wall on piles was anchored to the cribwork behind it using iron anchor bolts, tied into the existing cribwork by means of pine "dead men" attached to the inner crib face.[24]

While this was clearly a more economical method of construction than building deep-wall all along the south side (as had been done for the north), saving the expense of both dredging and casting and setting the massive underwater blocks for this area, it was evidently also inferior. The 1976 condition report documents that there was washout all along the westernmost area (as opposed to intermittent areas elsewhere along this section of wall) corresponding to the area where this different construction method was used.[25]

Like the wall on north side of ferry basin, the Contract 2 wall was built in front of the existing cribwork. The drawing shows the distance between the new wall and existing cribwork to be 9 feet at the top, like Contract 1, although it is not certain if this was followed exactly or if (also like Contract 1) the distance was slightly greater. The space in back of the masonry wall was filled, as with the area to the north, partially with ash and partially with earth and stone ballast from War Department ships.[26]

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[24] "Specification for all labor required for sheet Piling, etc. behind present crib work along northeast face of Island no. 2," August 12, 1915, paragraph 114, and figure 30; File 558C; Box 55640; Entry 9; RG 85; NARA I.

[25] *Seawall Rehabilitation and Walk Repair- Ellis Island*, URS/Madigan-Praeger, Inc. (August 1976).

[26] Byron Uhl, Assistant Commissioner, to Commissioner-General of Immigration, November 18, 1916, and February 3, 1919; File 558D; Box 55640; Entry 9; RG 85; NARA I.

Contract 3: Wall along Southeast Sides of Islands Two and Three, across Basin Between Islands Two and Three, and along Southwest Side of Island Three, 1918-1920

With a total length of almost 1,500 feet, the third seawall contract was the greatest length constructed at one time. It extended from the southeast corner of Island Two, along the southeast sides of Islands Two and Three, around the southwest corner and up the southwest side of Island Three (fig. 32). This section of seawall, like the second, also used several construction techniques based on the varying bottom conditions and the function of the wall. Much of this wall section was intended simply as a breakwater and retaining wall in the relatively shallow waters surrounding Islands 2 and 3 (all navigation and docking occurred in the ferry basin between Islands 1 and 2, and on the northeast side of Island 1). Therefore, most of it was built directly on top of the existing wood crib, using the same upper-wall construction techniques as for the two earlier contracts. Using the cribbing for the wall foundation was obviously more cost-effective than dredging for and constructing a new foundation, and allowed work to proceed relatively quickly.

The construction, consisting of series of buttressing triangular "counterforts" extending from the top of the masonry wall to the back line of the crib work, is depicted most clearly on the lower left side of the *Scientific American* cover from April 26, 1919 (fig. 20). A photograph submitted by the contractors illustrates their construction (fig. 28). These counterforts were revealed in test pits dug in 2002 by the Army Corps of Engineers.

Deep-wall on bag-work construction, placed in a dredged trench, was used in the gap between Islands Two and Three where there was no preexisting crib. Deep-wall on pile construction was used for 33 feet to either side of this, presumably to "anchor" what would have otherwise been a freestanding section of wall. Both of these wall types—deep-wall on bag-work and deep-wall on piles—had the same construction as their counterparts in Contract 2. Deep-wall on pile construction was also used at the northeast corner of Island Two, to anchor the corner of the seawall at the transition from the already constructed deep wall of Contract 2 to the shallower new construction.[27]

A 15-foot opening between Islands Two and Three was left in the upper wall to accommodate a walled, reinforced concrete ramp supported by piles that extended from mean low water at its lower top edge to grade level at its upper edge, 50 feet back from the line of the wall.[28] The opening and ramp can be seen in a 1920 photograph (fig. 18).

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[27] The construction of the seawall at the southeast corner of Island Two differs slightly from the deep-wall construction elsewhere on the island, in that the foundation for the upper wall was cast in place using sheet piling for forms, rather than lowering a precast block; see figure 32, details of Plan and Elevation at "D," and "Specification For All Labor and Materials Required to Construct Section of Sea Wall...Under 'Sea Wall Contract Number Three'" (Appendix C), paragraphs 71-75.

[28] "Specification For All Labor and Materials Required to Construct Section of Sea Wall...Under 'Sea Wall Contract Number Three'" (Appendix C), paragraphs 63-69.

Fill was deposited between Islands Two and Three before the construction of the wall section between them. It was obtained from ship ballast, and from the dredging for Contract 4 (which had gotten underway the previous year) on the far side of Island One.[29] Much of the cribwork lining the space between the islands was left in place. One exception was 42 fender piles, which were removed from the slip in 1918 for use along the seawall at the north of the ferry channel, to protect the wall from battering by docking ferries.[30]

Contract 4: Northeast Side of Island One, 1918- 1920

The fourth section of seawall construction, approximately 50 feet offshore and 450 feet along the center of the northwest side of Island One, consisted exclusively of deep- wall construction on bag- work, as described for Contract 1 (fig. 33).

Contract 5: Northwest Corner of Island One, 1920- 1921

The fifth section of seawall construction rounded the northeast corner of the island and consisted of 300 feet of deep- wall on bag- work construction along its northeast side, and 200 feet of shallow- wall on pile construction along its shallower northwest side (fig. 34). The deep-wall construction was the same as that described for the preceding contracts. The shallow- wall construction was similar to that described for Contract 2, but differed in that the platform supporting the upper 11 feet of the wall on top of the foundation piles was a 12- inch- thick concrete slab instead of framed wood decking (fig. 34, upper right corner). The drawing shows that wood piling was used beneath the corner foundation for reinforcement in this area.

The riprap used under the pile caps of the foundation came from the ballast of War Department ships.[31] The fill used between the old cribbing and new seawall, which was noted as having been procured “without cost to the government,” was therefore probably from the same source.[32]

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[29] Letter from Byron Uhl, Assistant Commissioner, to Commissioner- General of Immigration, February 3, 1919, and letter from Fry to Acting Commissioner Baker, August 25, 1919; File 558D; Box 55640; Entry 9; RG 85; NARA I.

[30] Letter from the Phoenix Construction Company to F.S. Howell, Civil Engineer, May 9, 1918; File 558D; Box 55640; Entry 9; RG 85; NARA I.

[31] Letter from Byron H. Uhl, Commissioner of Immigration, to Commissioner- General of Immigration, February 3, 1919; File 558D; Box 55640; Entry 9; RG 85; NARA I.

[32] Letter from Byron H. Uhl, Commissioner of Immigration, to Commissioner- General of Immigration, January 11, 1921; File 558G; Box 55640; Entry 9; RG 85; NARA I.

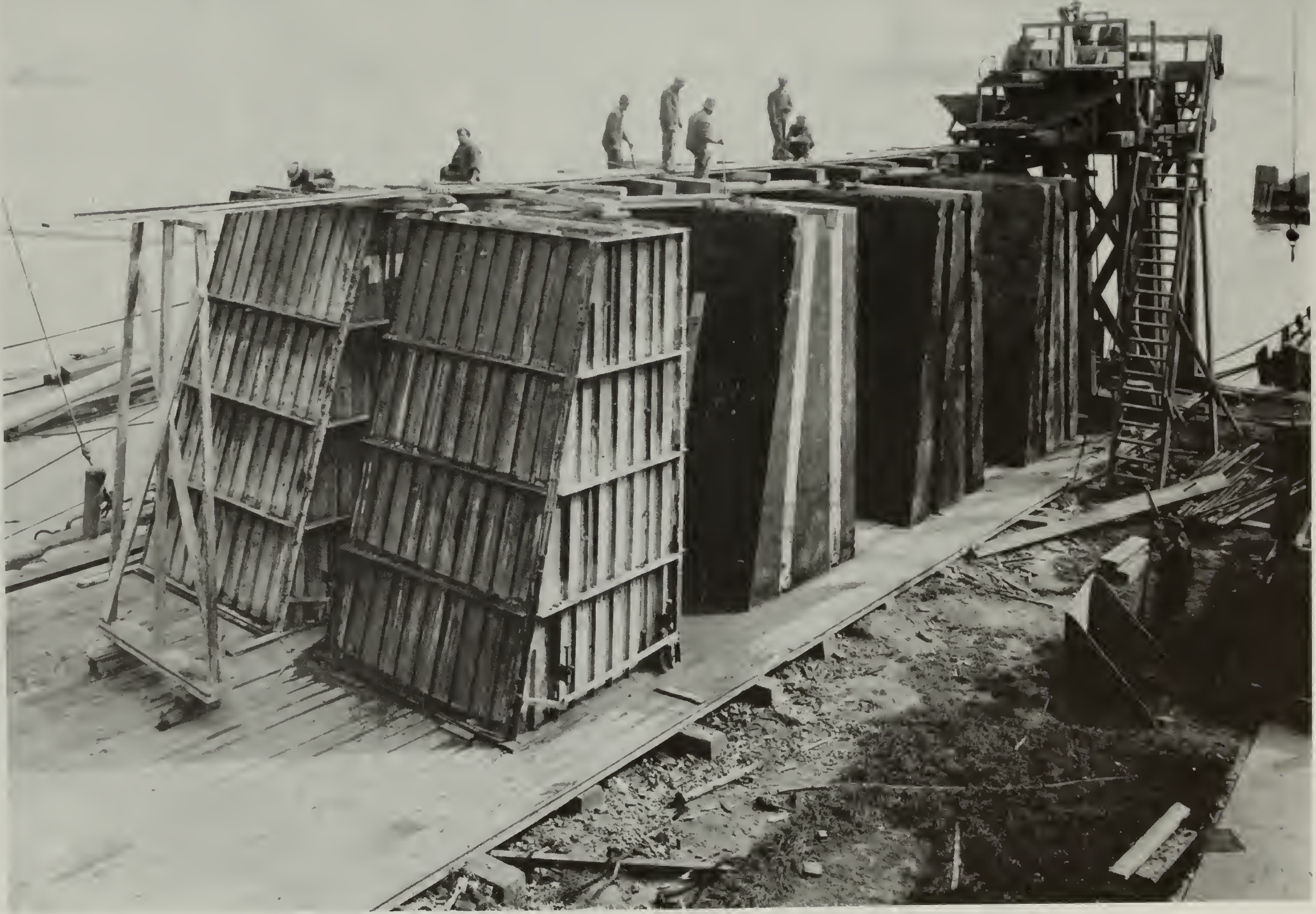


Figure 26. Casting of underwater concrete blocks for Contract 1, May 17, 1913.

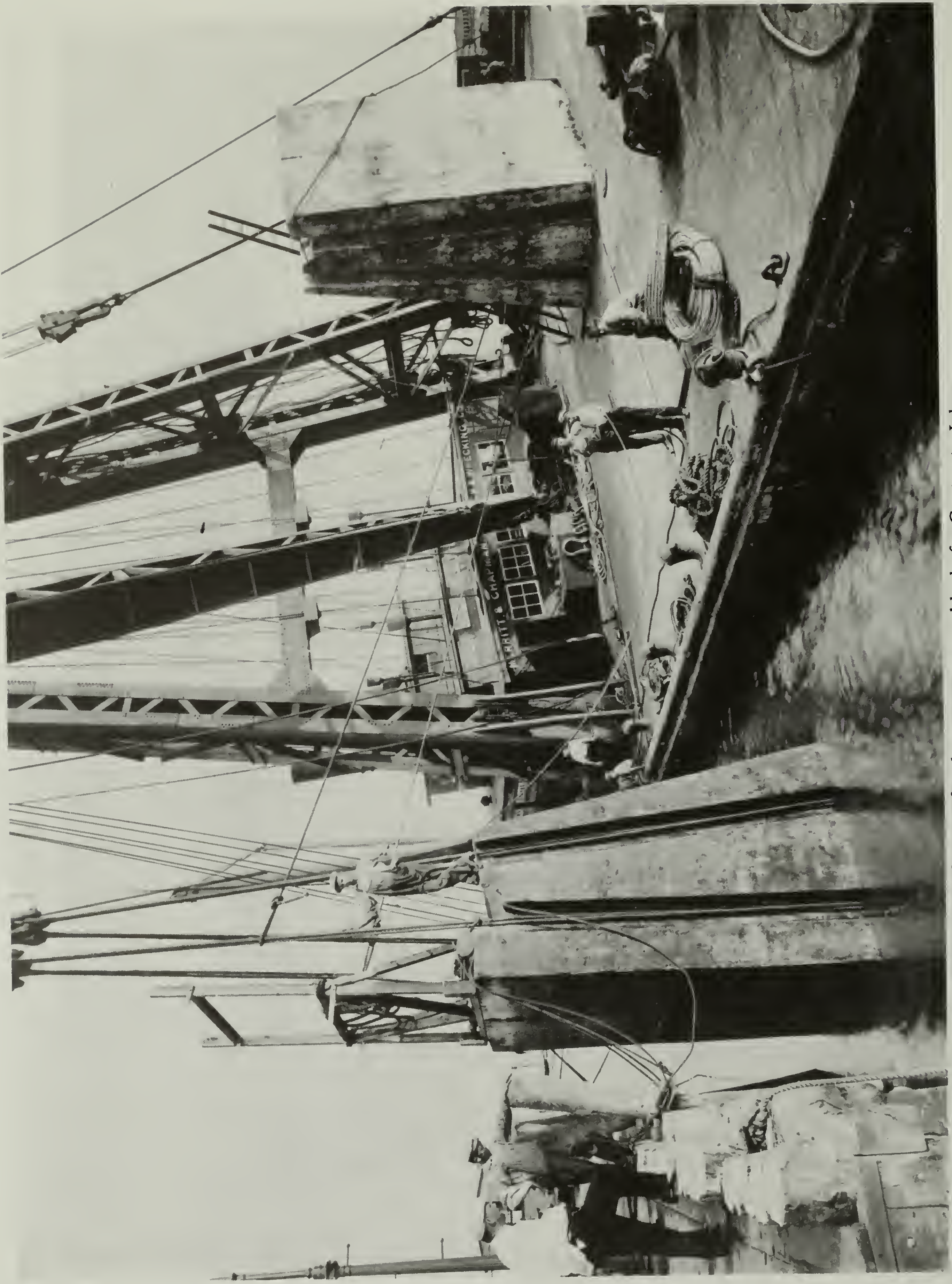


Figure 27. Setting of underwater concrete blocks for Contract 1, July 19, 1913.

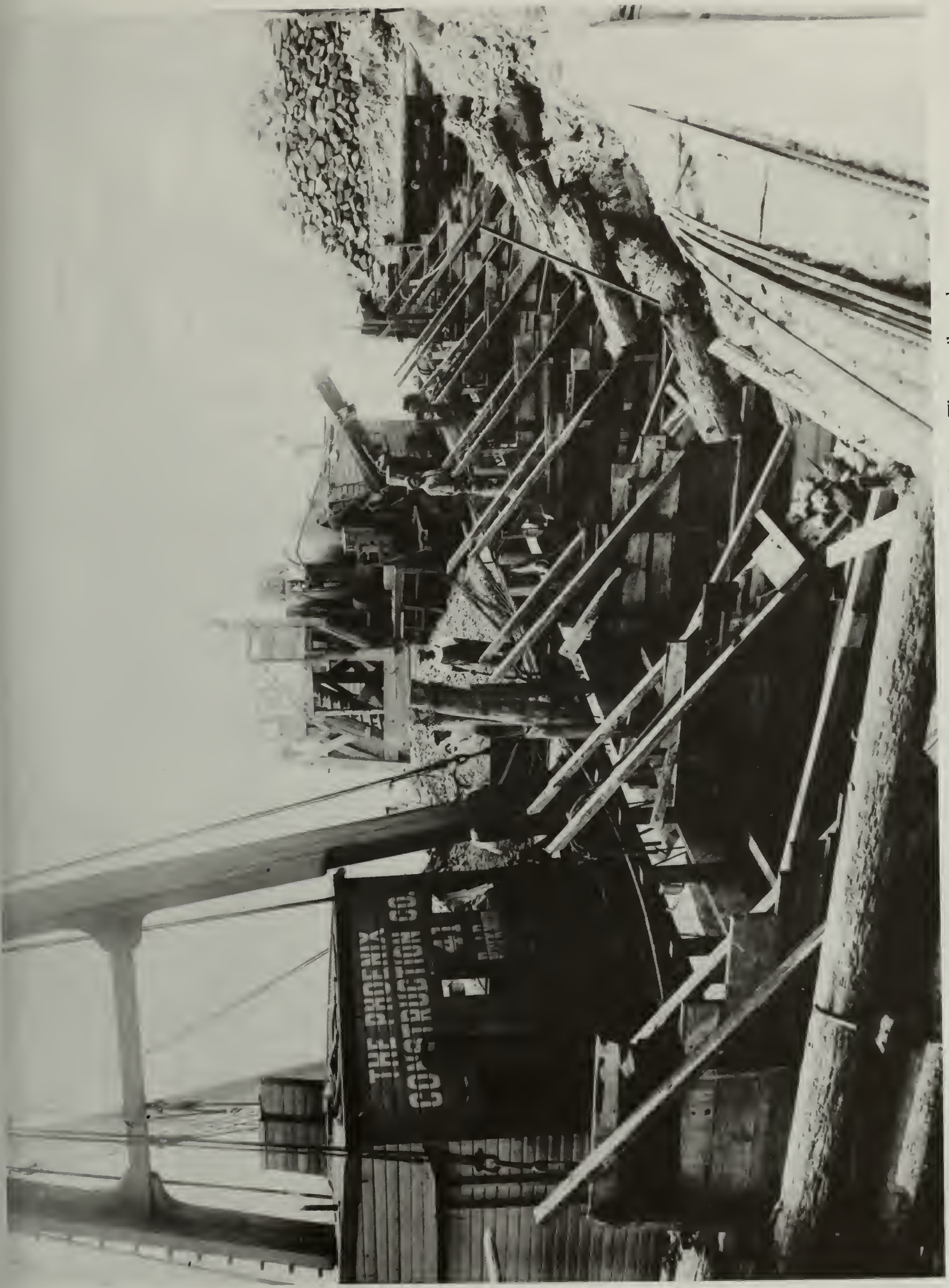


Figure 28. Construction of concrete counterforts on top of Island Two or Three cribwork, 1917.

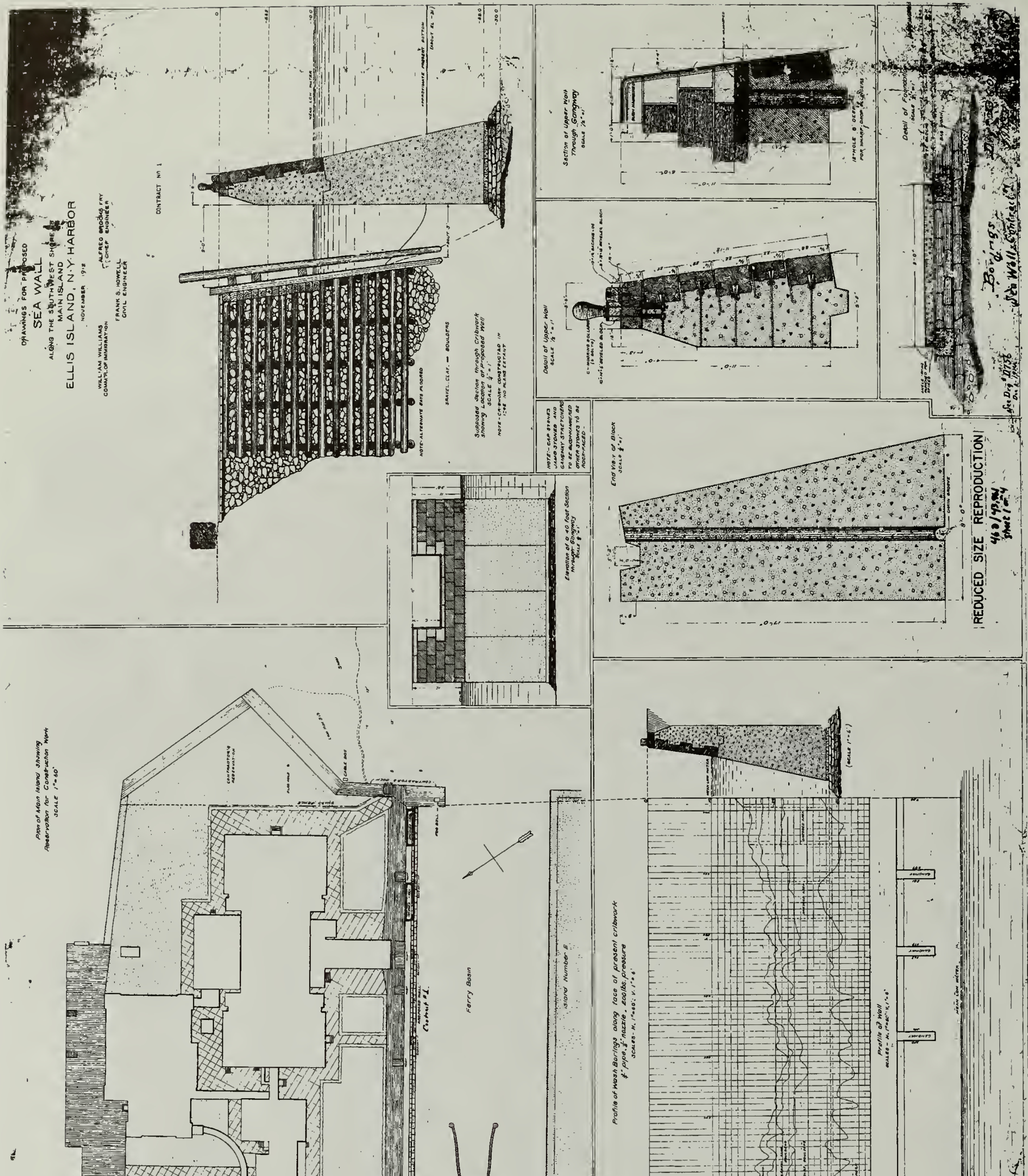

DRAWINGS FOR PROPOSED
SEA WALL
ALONG THE SOUTHWEST SHORE
MAIN ISLAND
ELLIS ISLAND, N.Y. HARBOR
NOVEMBER 1912
WILLIAM WILLIAMS
COMM'R OF IMMIGRATION
FRANK S. HOWELL
CIVIL ENGINEER
ALFRED BROOKS FRY
CHIEF ENGINEER
CONTRACT No 1
Supposed Section through Cribwork Showing Location of proposed Wall
Section of Upper Wall Through Gangway
Detail of Upper Wall
Detail of Foundation
Elevation of a 40 foot Section through Gangway
End View of Block
REDUCED SIZE REPRODUCTION
Plan of Main Island Showing Reservation for Construction Work
SCALE 1"=60'
Ferry Basin
Island Number 2
Profile of Wash Borings along face of present cribwork
Profile of Wall
Borings
Sea Wall Contract

Figure 29. Drawing, Seawall Contract No. 1, November 1912.

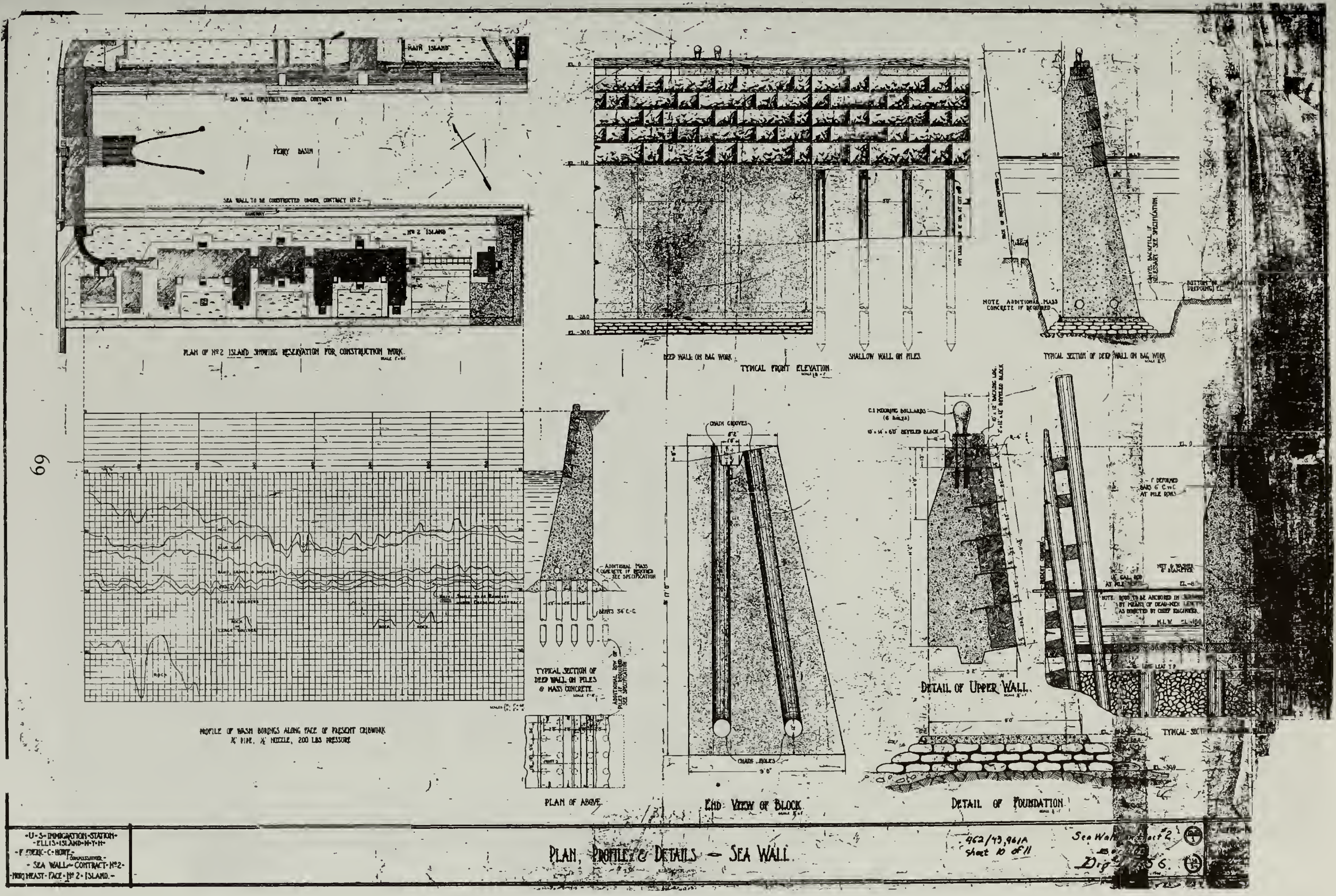

RAIN ISLAND
SEA WALL CONSTRUCTED UNDER CONTRACT Nº 1
FERRY BASIN
SEA WALL TO BE CONSTRUCTED UNDER CONTRACT Nº 2
Nº 2 ISLAND
PLAN OF Nº 2 ISLAND SHOWING RESERVATION FOR CONSTRUCTION WORK
DEEP WALL ON BAG WORK
TYPICAL FRONT ELEVATION
SHALLOW WALL ON PILES
NOTE ADDITIONAL MASS CONCRETE IF REQUIRED
GRAVEL BACKFILL IF NECESSARY SEE SPECIFICATION
BOTTOM OF DREDGING EL.
TYPICAL SECTION OF DEEP WALL ON BAG WORK
BLUE CLAY
ROCK
CLAY & BOULDERS
PROFILE OF WASH BORINGS ALONG FACE OF PRESENT CRIBWORK
¾" PIPE, ¼" NOZZLE, 200 LBS PRESSURE
ADDITIONAL MASS CONCRETE IF REQUIRED SEE SPECIFICATION
BENTS 3'6" C-C
TYPICAL SECTION OF DEEP WALL ON PILES & MASS CONCRETE
ADDITIONAL ROW OF PILES IF REQUIRED SEE SPECIFICATION
PLAN OF ABOVE
CHAIN GROOVES
CHAIN HOLES
END VIEW OF BLOCK
C.I. MOORING BOLLARDS
BEVELED BLOCK
DETAIL OF UPPER WALL
DETAIL OF FOUNDATION
M.L.W.
TYPICAL SECT
·U·S·IMMIGRATION·STATION·
·ELLIS·ISLAND·N·Y·H·
·F·DERIC·C·HOWE· COMMISSIONER·
·SEA WALL—CONTRACT·Nº2·
·NORTHEAST·FACE·Nº 2·ISLAND·
PLAN, PROFILE & DETAILS — SEA WALL
462/43,961A
sheet 10 of 11
Sea Wall Contract #2
Drg 56.

Figure 30. Drawing, Seawall Contract No. 2, December 3, 1914.

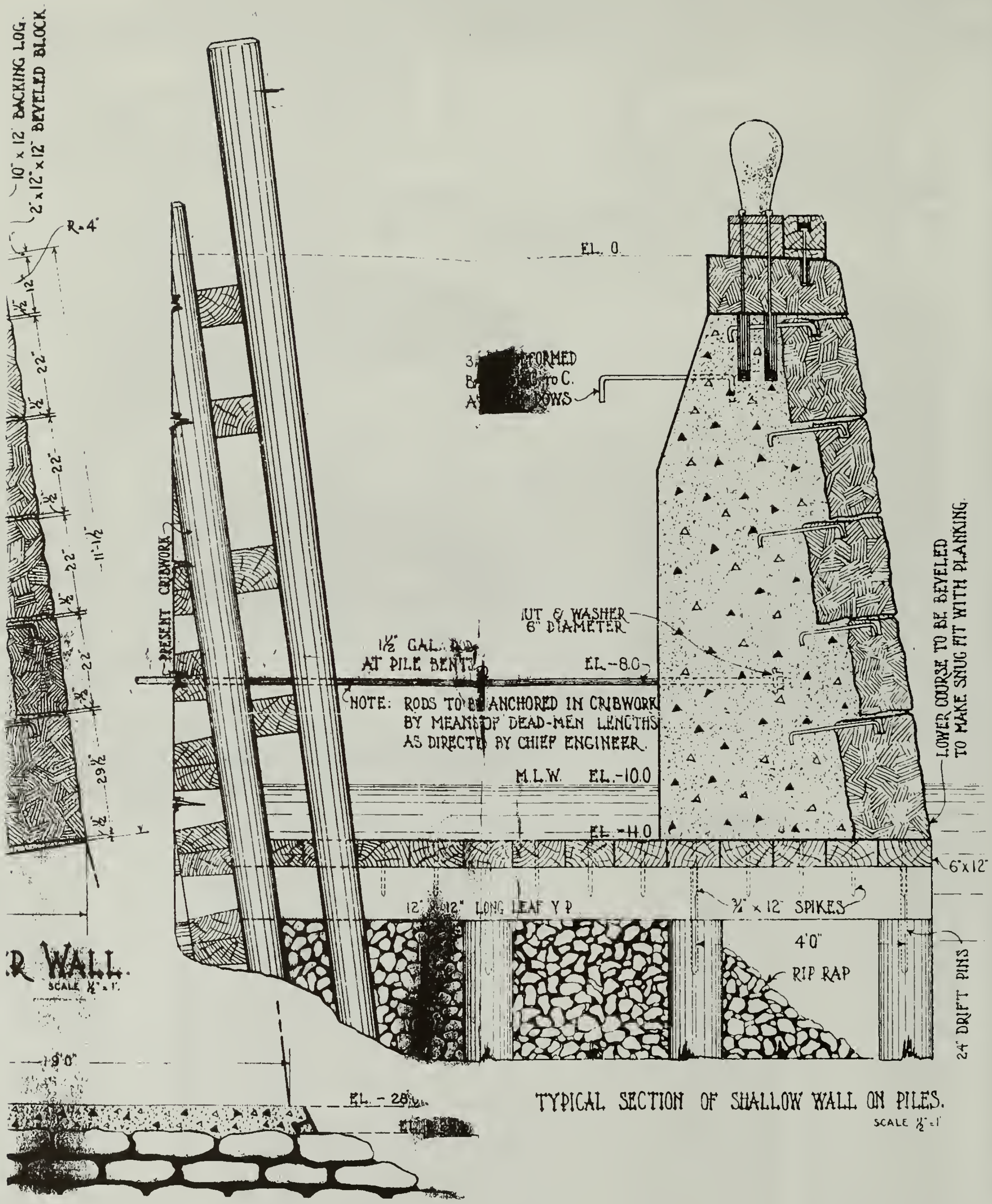


Figure 31. Lower left detail of Contract 2 drawing, December 3, 1914.

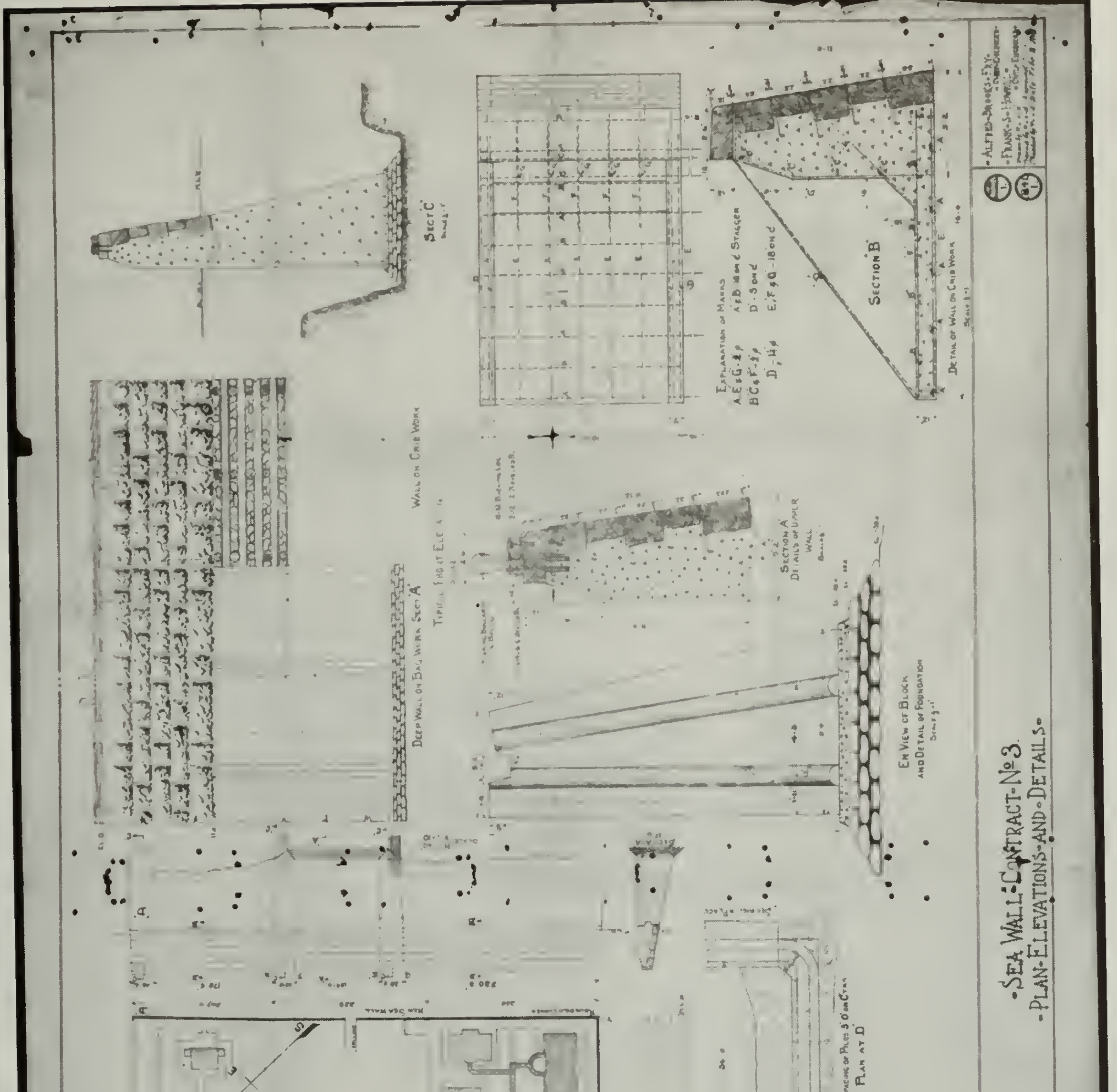


Figure 32. Drawing, Seawall Contract No. 3, February 2, 1918.

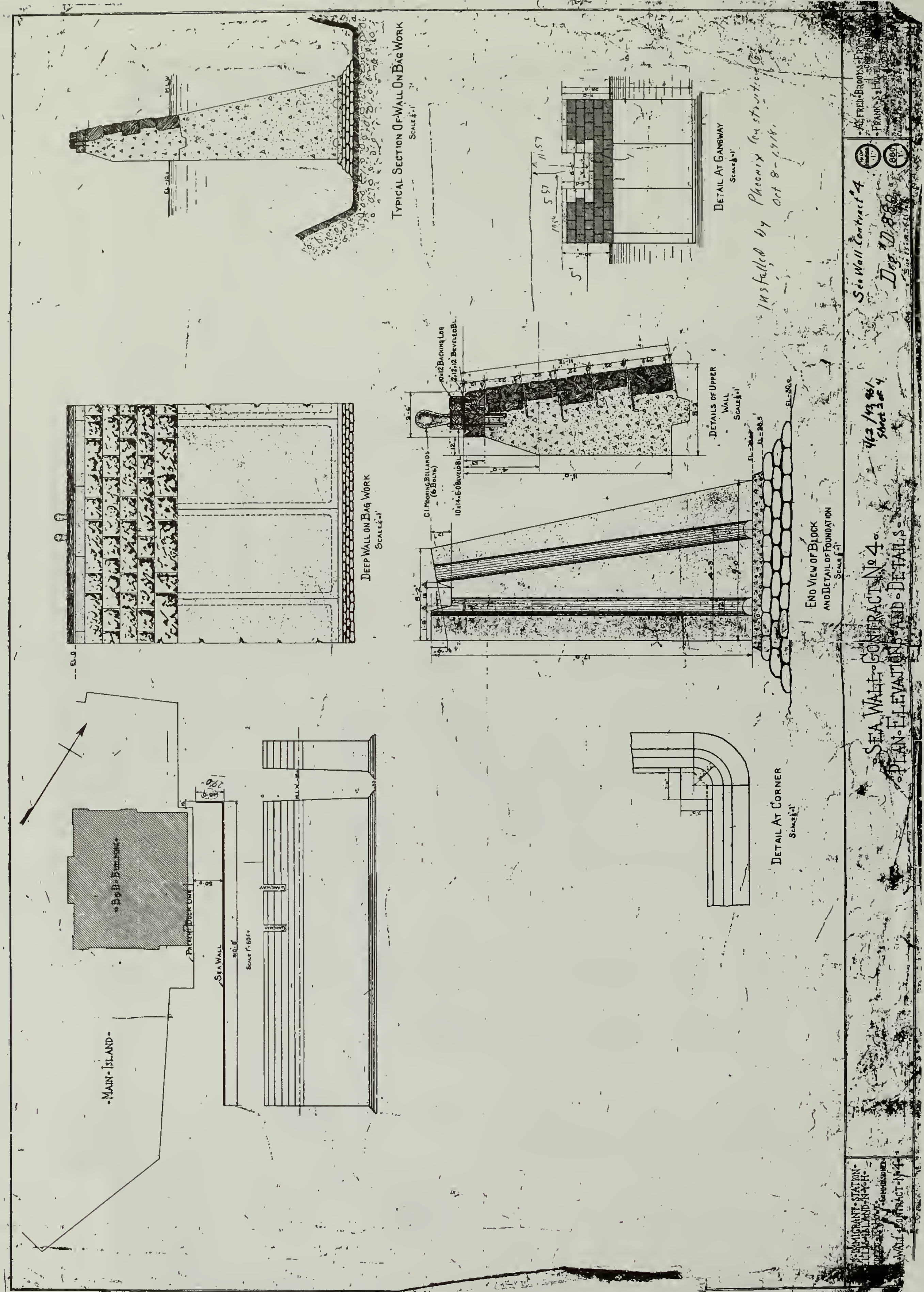


Figure 33. Drawing, Seawall Contract No. 4, October 1918.

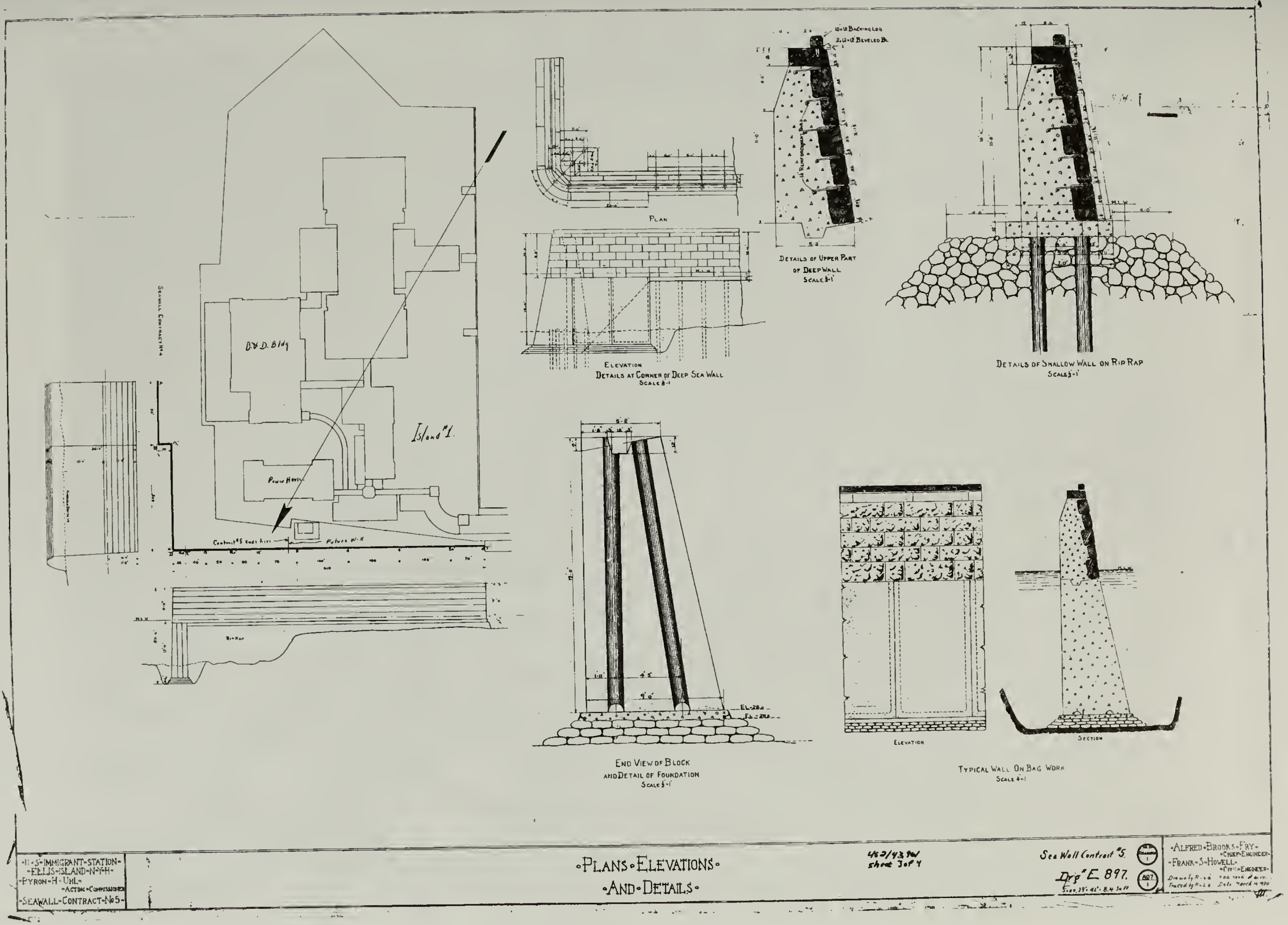


Figure 34. Drawing, Seawall Contract No. 5, March 14, 1920.

WPA ERA THROUGH DETENTION CENTER USE:
CIRCA 1933- 1954

The specification for the 1933 seawall that completed the masonry perimeter is reproduced in Appendix D. The accompanying drawings are reproduced in figures 39- 45. In contrast to the previous cribbing and seawall contracts, whose specifications were almost as detailed as the accompanying drawings, here the drawings provide most of the construction information and the specifications reinforce their details. The details of the concrete specifications reflect two advances that occurred in the United States in the 1930s. These were the increased sophistication of concrete construction (e.g., the use of admixtures to manipulate working properties), and the development of professional standards by the portland cement industry (e.g., ASTM slump testing),

Construction for all of the remaining wall sections consisted of precast concrete sheet piles joined by means of tongue- and- groove sections along their bottom half, with a ledged profile upon which to rest the granite facing blocks (fig. 35 and lower left details, fig. 41). After the piles were closely driven along the wall section (fig. 36), granite blocks were placed in a single wythe on the pile's cast- in ledge and secured with galvanized iron anchors and a mortar backing (fig. 37). The length of the facing stones was alternated to create the impression of headers and stretchers, to match the existing seawall. The wall was topped with a capstone, and the entire granite face was pointed.

Each pile for the sections other than Section 3 was tied into structures behind the seawall with long galvanized iron tiebacks. The Section 1 piles were tied into the existing wooden crib and, farther back, to a concrete "dead man" inserted in the riprap (lower left, fig. 39). The Section 2 and 4 piles were tied into concrete dead men supported on wood tension piles (figs. 40 and 42), and the Section 5 piles were tied into concrete dead men both at the front and at the rear of the existing crib (fig. 44).

The sheet piling of Section 3 was buttressed with square, precast concrete piles that met the back of the sheet pile at an opposing angle (fig. 41).

Sections 1, 2, and 4 were all vertical walls; Sections 3 and 5 had a batten to match the existing seawall that they abutted. Sections 2, 4, and 5 had a granite parapet wall on top of the piling that rose above grade.

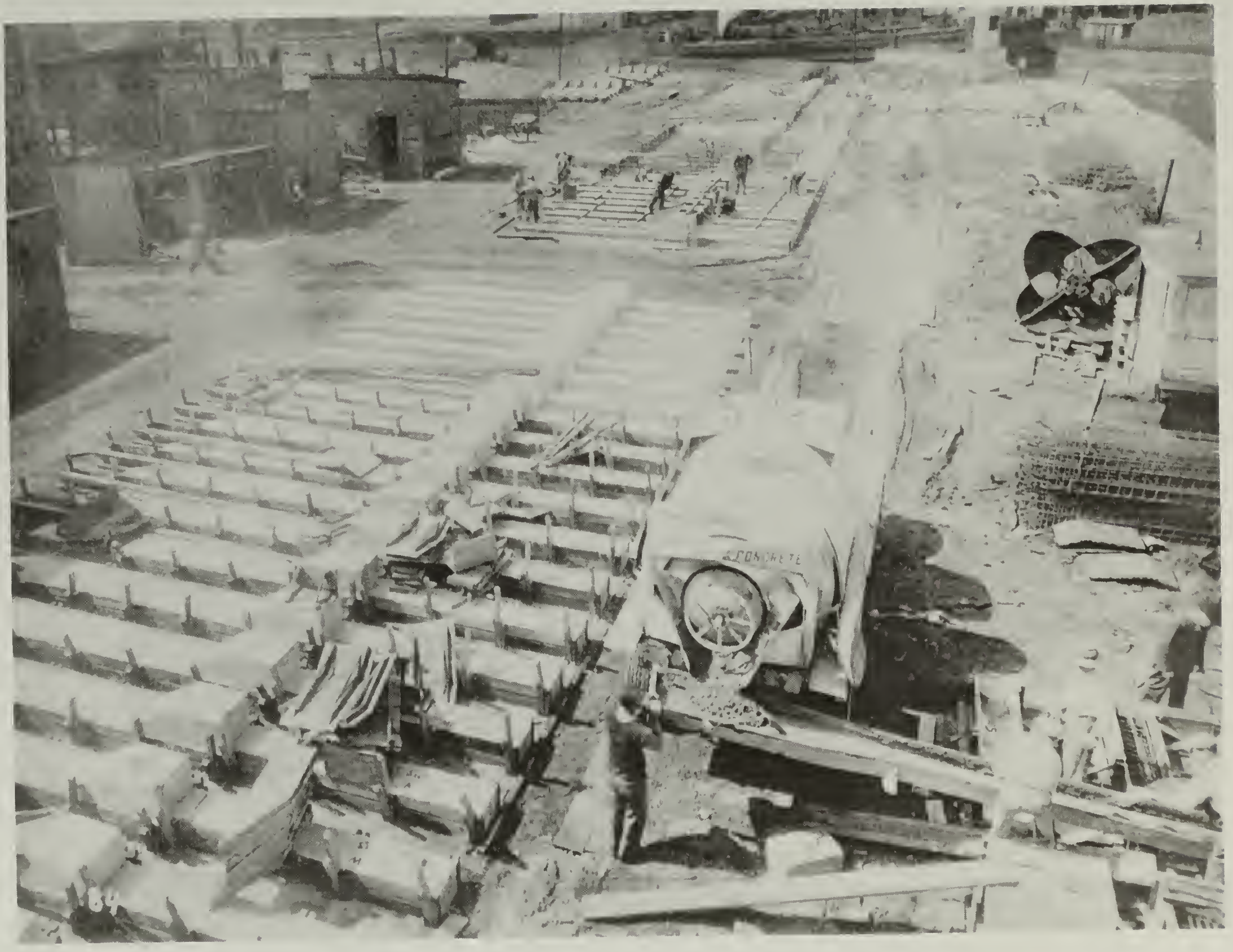


Figure 35. Casting of concrete sheet piles, April 2, 1934.

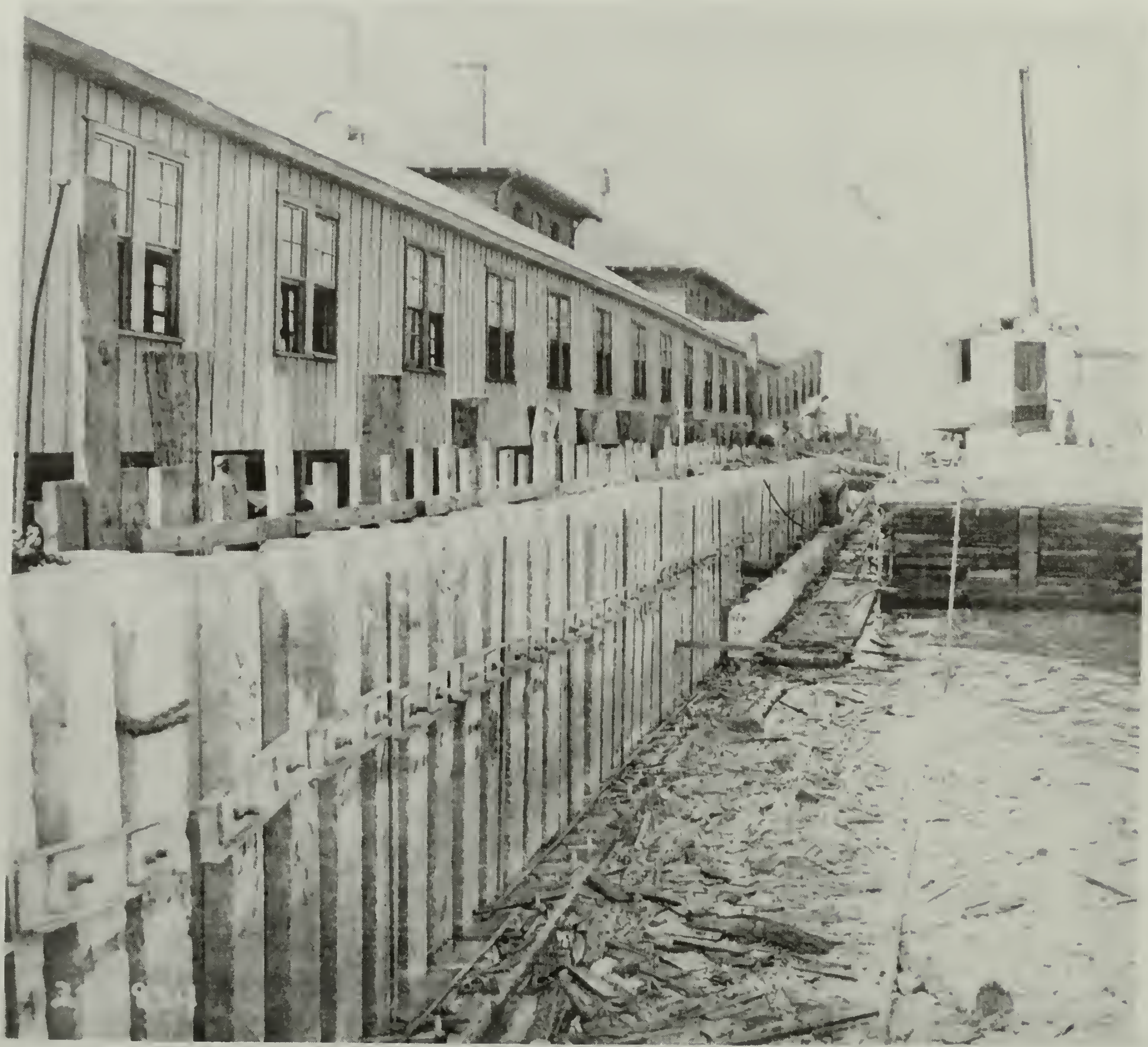


Figure 36. Concrete sheet piles in place, Section 1 (northwest side of Island Three), August 1, 1934.

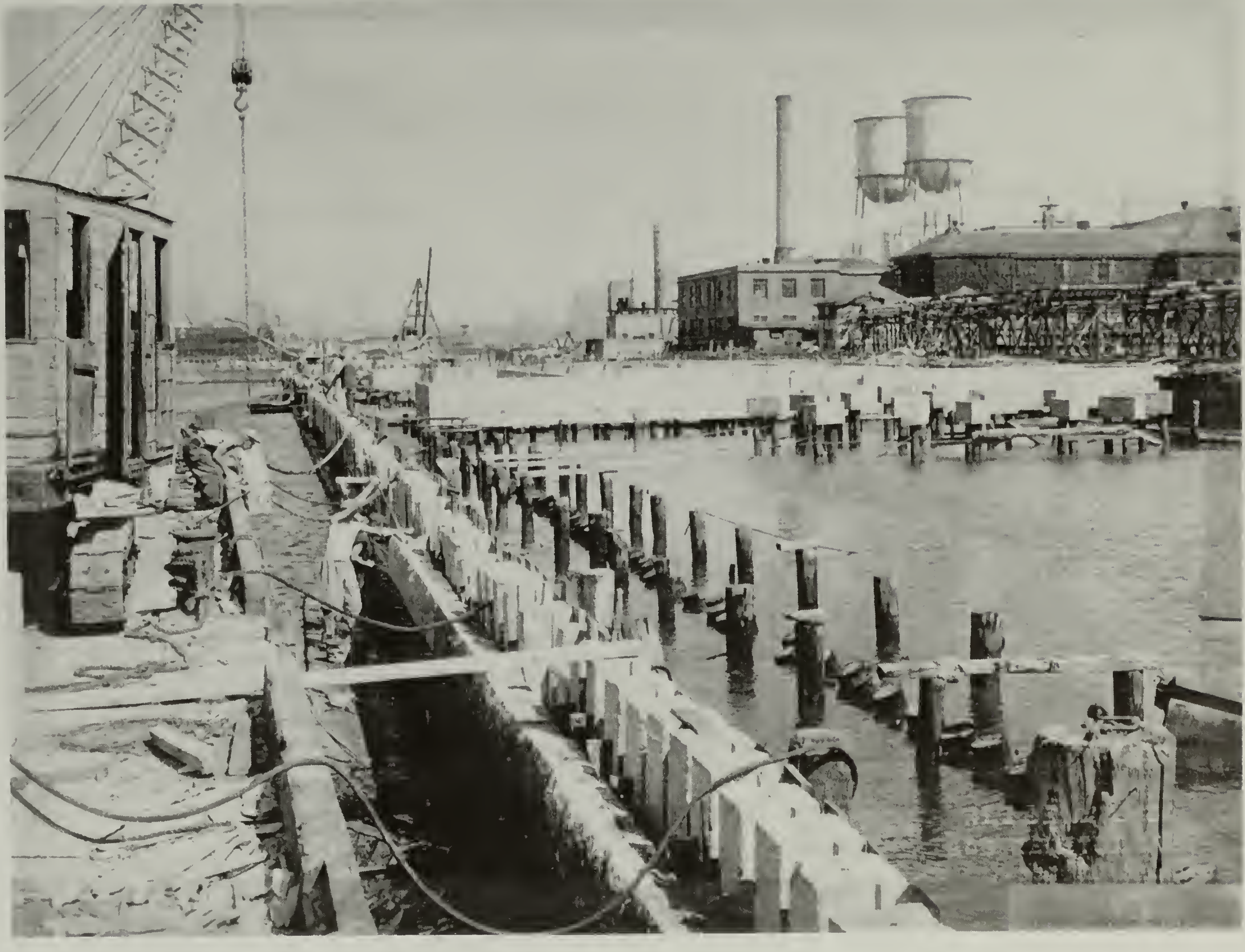


Figure 37. Setting of granite blocks on concrete sheet piling, Section 2 (northwest side of island complex, looking northeast), September 24, 1934.

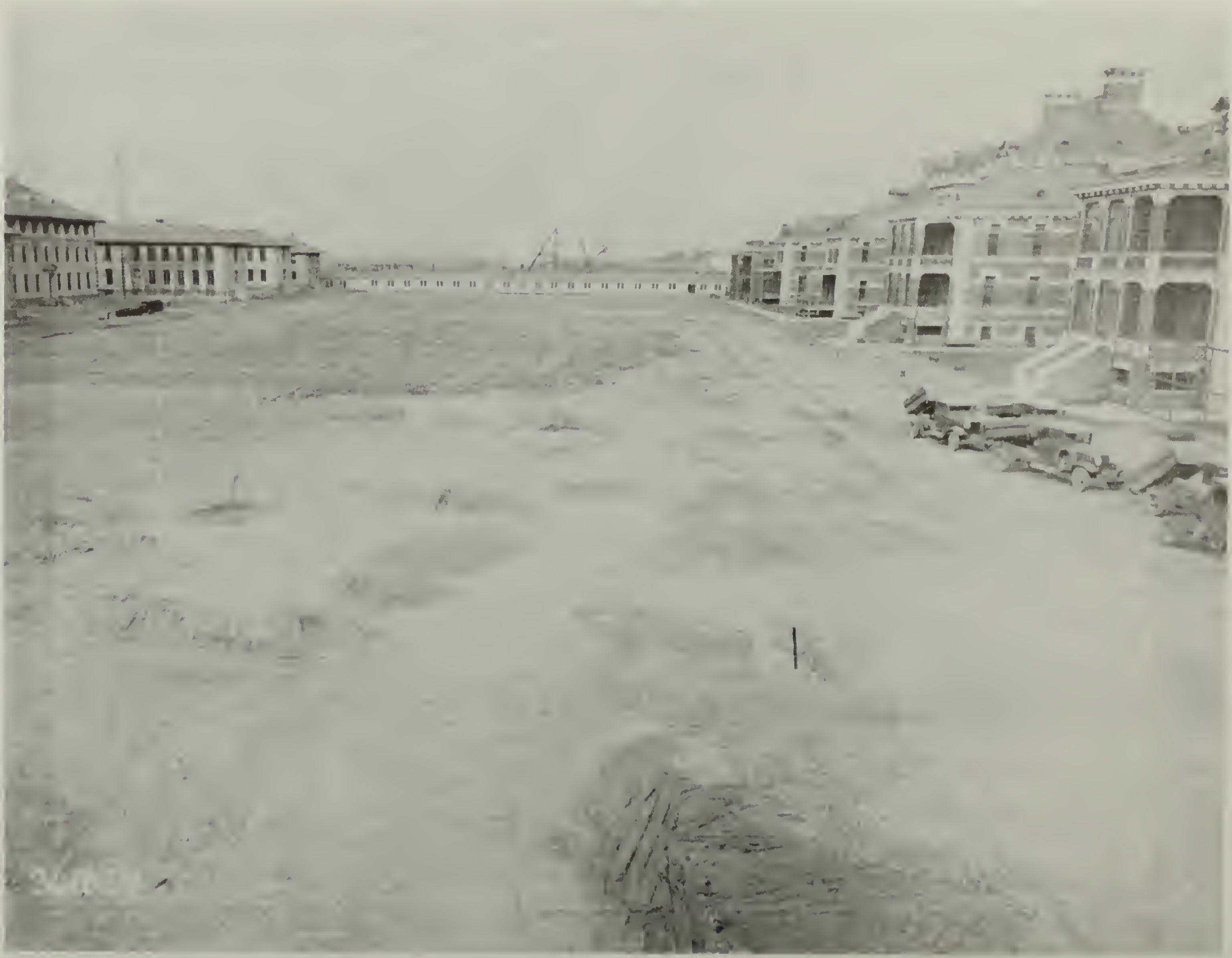


Figure 38. Fill between Islands Two and Three, looking northwest, September 28, 1934.

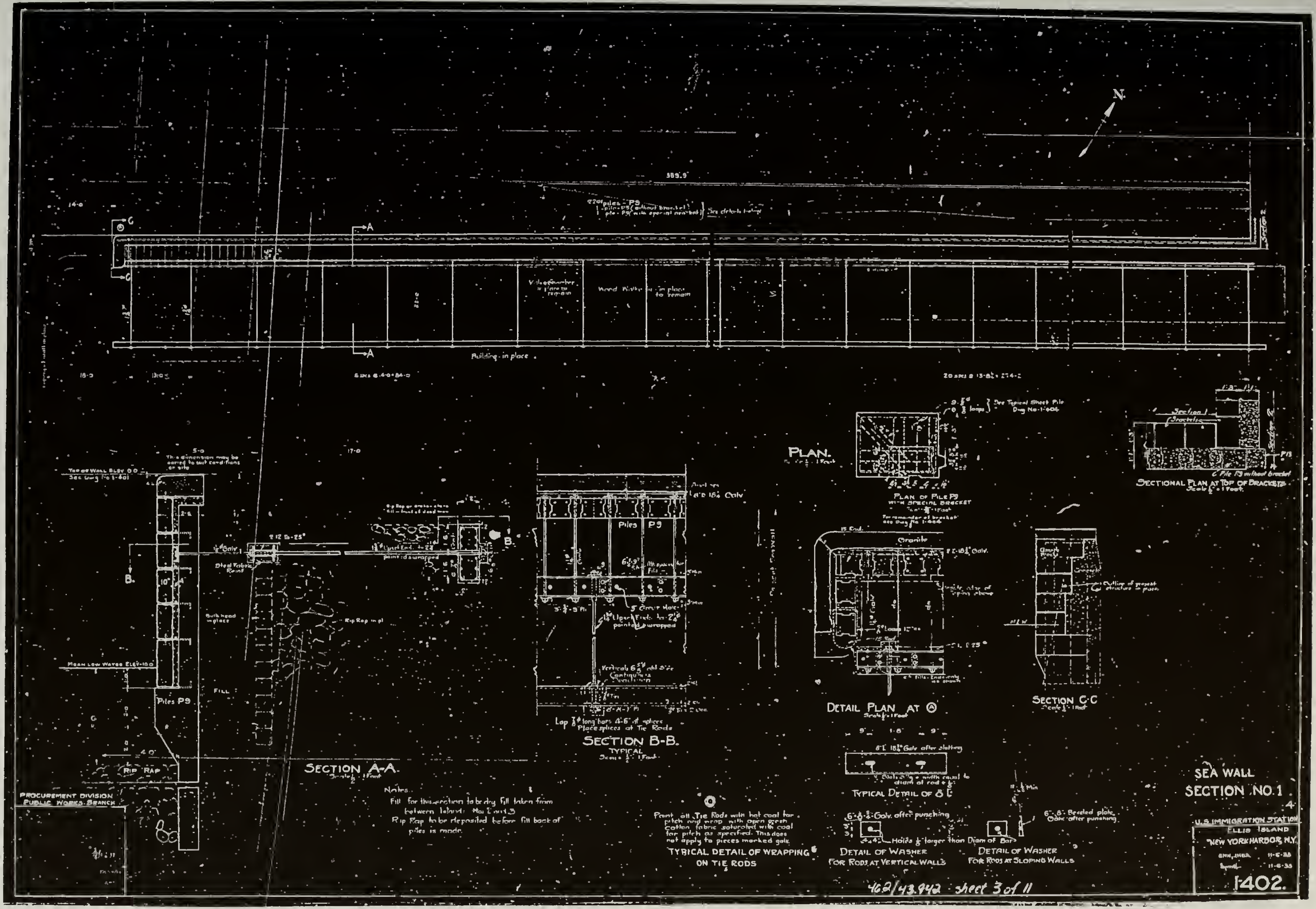

N
Building in place
PLAN.
SECTION A-A.
SECTION B-B.
TYPICAL
Piles P9
RIP RAP
FILL
DETAIL PLAN AT Ⓐ
SECTION C-C
SECTIONAL PLAN AT TOP OF BRACKETS
PLAN OF PILE P9 WITH SPECIAL BRACKET
TYPICAL DETAIL OF WRAPPING ON TIE RODS
TYPICAL DETAIL OF δ
DETAIL OF WASHER FOR RODS AT VERTICAL WALLS
DETAIL OF WASHER FOR RODS AT SLOPING WALLS
Notes.
Fill for this section to be dry fill taken from between Islands No 1 and 3
Rip Rap to be deposited before fill back of piles is made.
Paint all Tie Rods with hot coal tar pitch and wrap with open green cotton fabric saturated with coal tar pitch as specified. This does not apply to pieces marked galv.
PROCUREMENT DIVISION
PUBLIC WORKS BRANCH
SEA WALL
SECTION NO. 1
U.S. IMMIGRATION STATION
ELLIS ISLAND
NEW YORK HARBOR, N.Y.
1402.
462/43.942 sheet 3 of 11

Figure 39. Section No. 1 drawing, November 6, 1911.

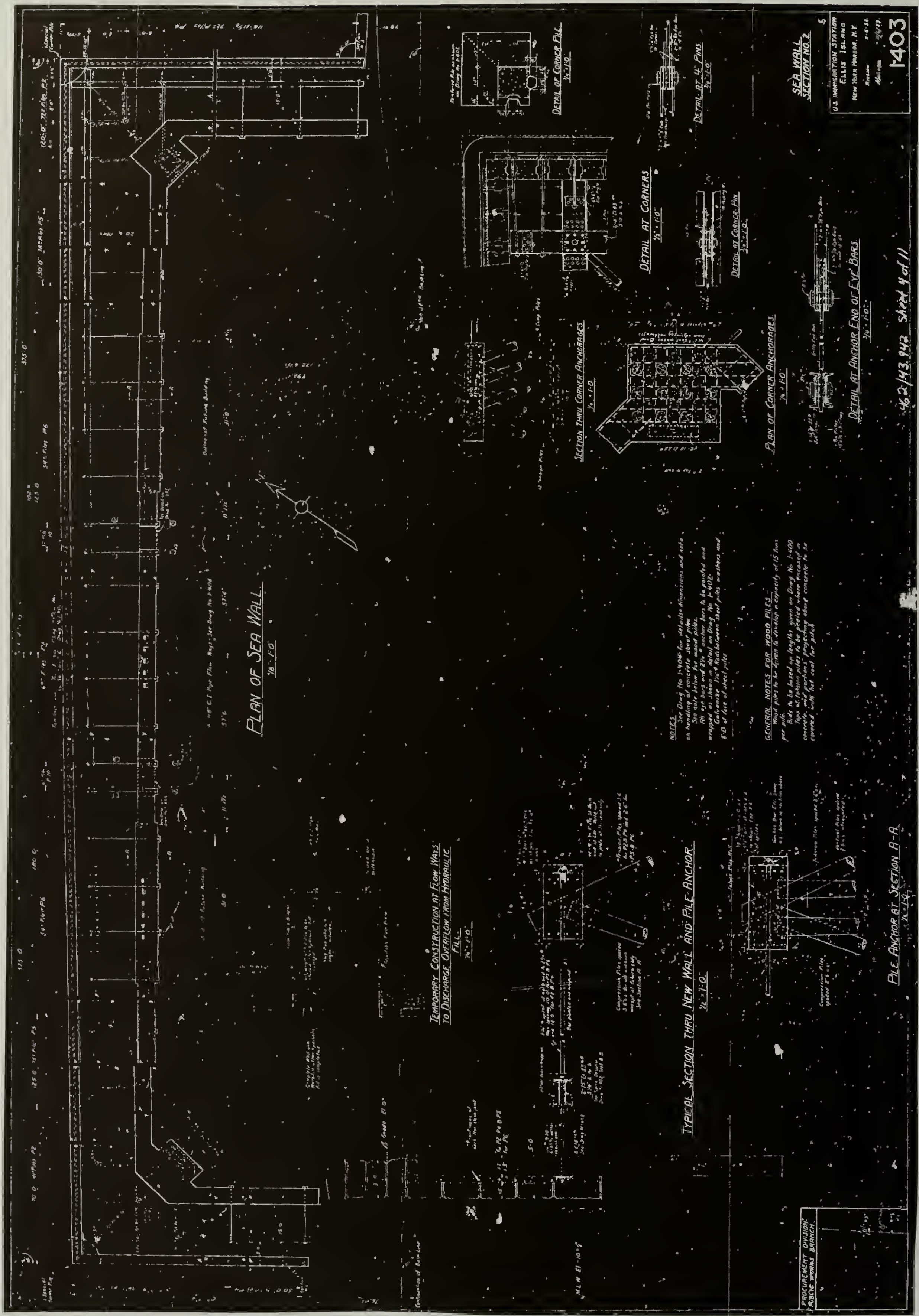

PLAN OF SEA WALL
1/8" = 1'-0"
TYPICAL SECTION THRU NEW WALL AND PILE ANCHOR
TEMPORARY CONSTRUCTION AT FLOW WAYS TO DISCHARGE OVERFLOW FROM HYDRAULIC FILL
PILE ANCHOR AT SECTION A-A
SECTION THRU CORNER ANCHORAGES
PLAN OF CORNER ANCHORAGES
DETAIL AT CORNERS
DETAIL AT CORNER PIN
DETAIL OF CORNER PILE
DETAIL AT 4" PINS
DETAIL AT ANCHOR END OF EYE BARS
NOTES
GENERAL NOTES FOR WOOD PILES
SEA WALL SECTION NO. 2
U.S. IMMIGRATION STATION ELLIS ISLAND NEW YORK HARBOR, N.Y.
1403
PROCUREMENT DIVISION PUBLIC WORKS BRANCH
62/143.942 Sheet 4 of 11

Figure 40. Section No. 2 drawing, November 6, 1911.

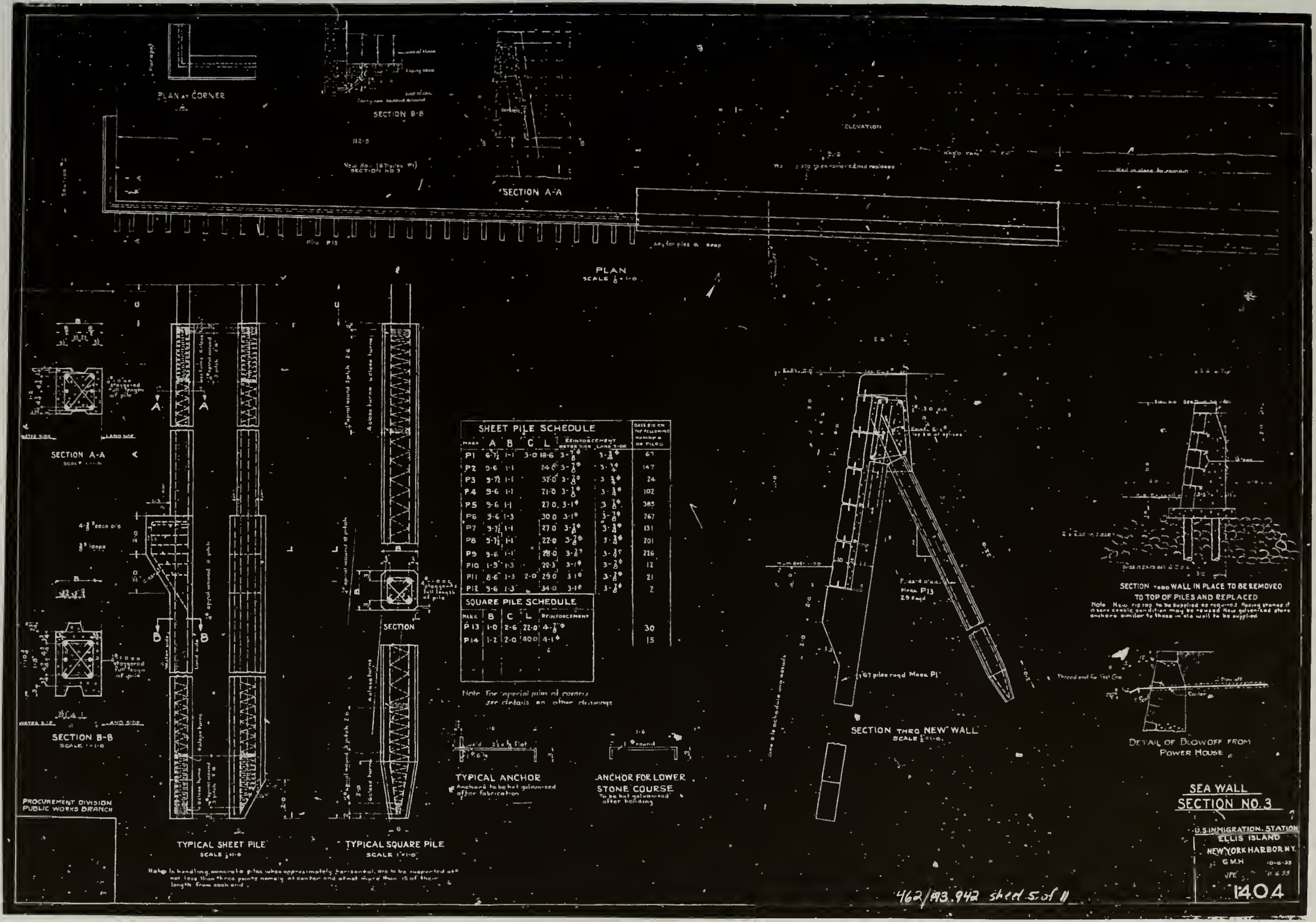


Figure 41. Section No. 3 drawing, November 6, 1911.

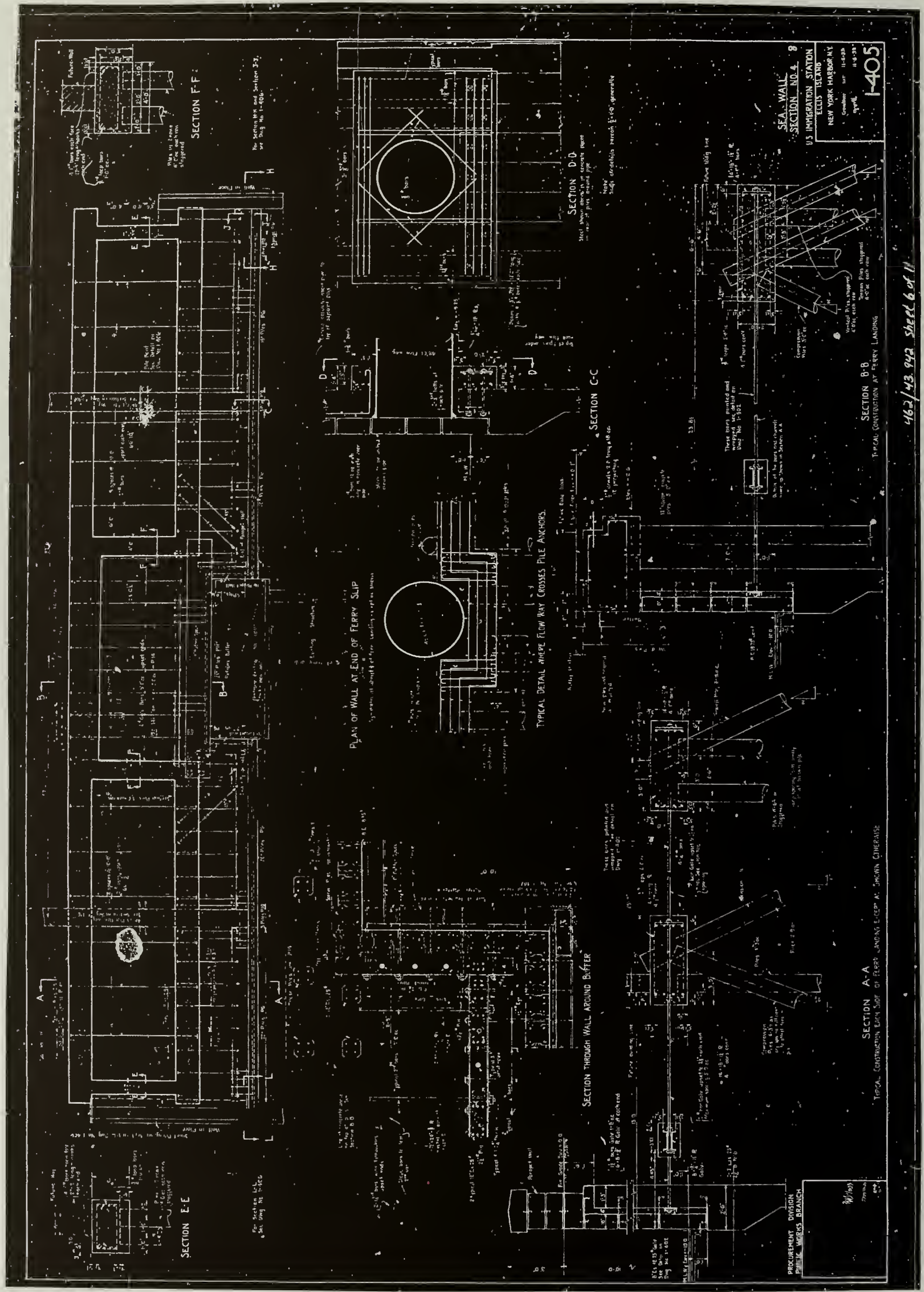

SECTION E-E
SECTION F-F
PLAN OF WALL AT END OF FERRY SLIP
TYPICAL DETAIL WHERE FLOW WAY CROSSES PILE ANCHORS
SECTION THROUGH WALL AROUND BUFFER
SECTION D-D
SECTION C-C
SECTION A-A
TYPICAL CONSTRUCTION EACH SIDE OF FERRY LANDING EXCEPT AS SHOWN OTHERWISE
SECTION B-B
TYPICAL CONSTRUCTION AT FERRY LANDING
SEA WALL SECTION NO. 4 B
US IMMIGRATION STATION
ELLIS ISLAND
NEW YORK HARBOR N.Y.
I-405
462/43 942 Sheet 6 of 11
PROCUREMENT DIVISION
PUBLIC WORKS BRANCH

Figure 42. Section No. 4 drawing, November 6, 1911.

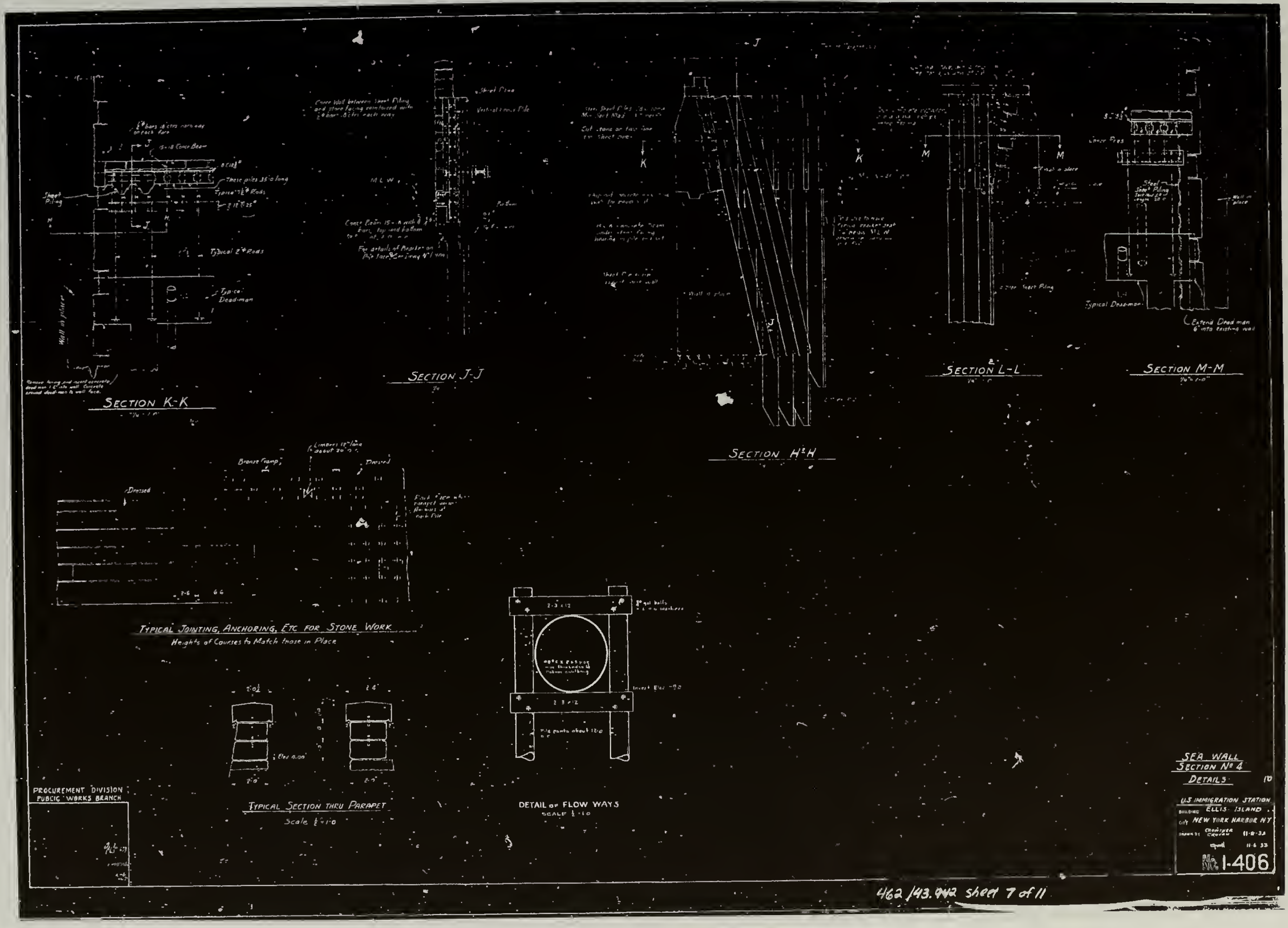
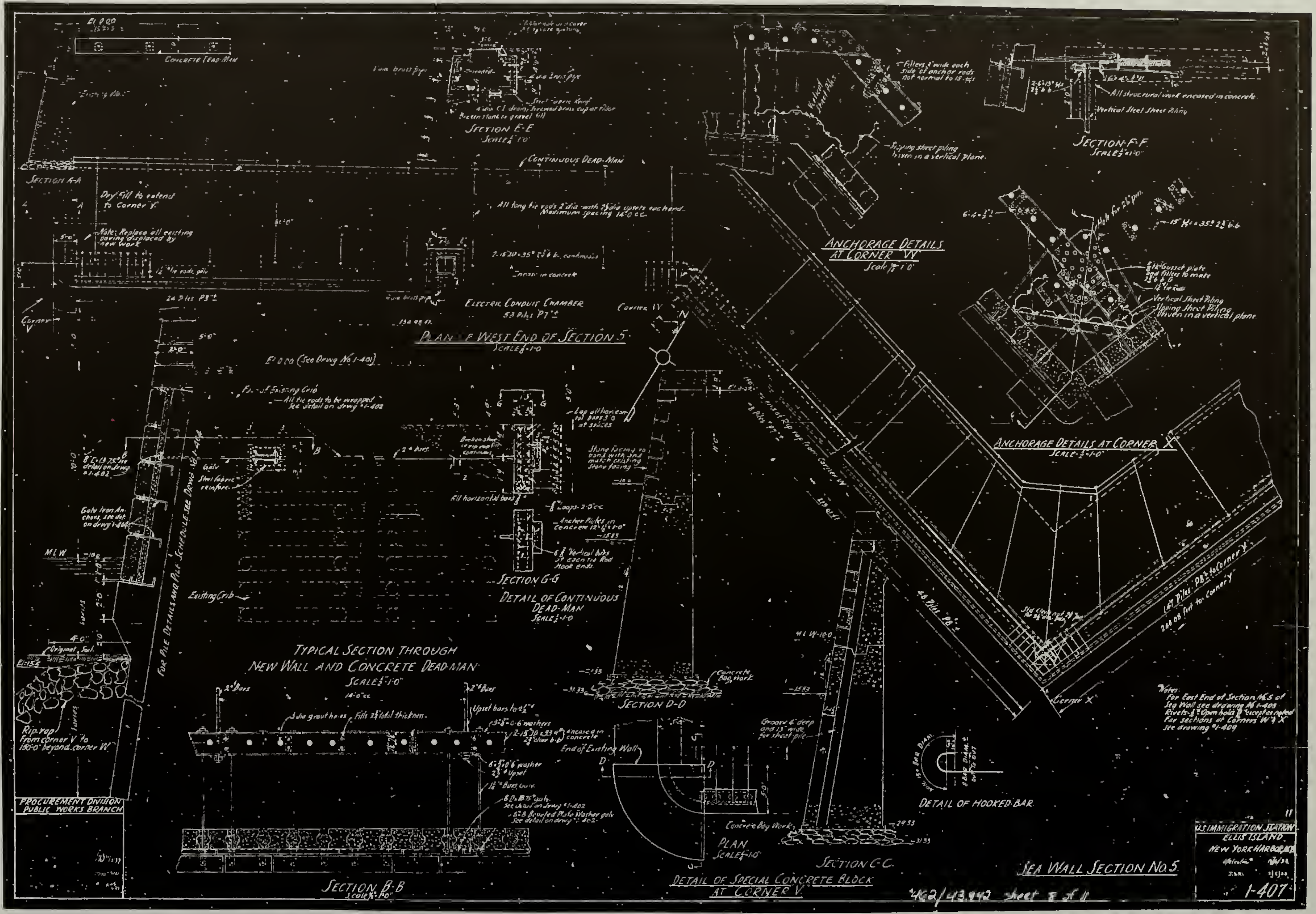


Figure 43. Section No. 4 details, November 6, 1911.



CONCRETE DEAD-MAN
SECTION A-A
Dry Fill to extend to Corner V
Note: Replace all existing paving displaced by new work
SECTION E-E
SCALE ½"=1'-0"
CONTINUOUS DEAD-MAN
All long tie rods 2" dia. with 2½" dia. upsets each end. Maximum spacing 14'-0" cc.
ELECTRIC CONDUIT CHAMBER
53 Piles P7
PLAN OF WEST END OF SECTION 5
Corner IV
Corner V
ANCHORAGE DETAILS AT CORNER W
Scale ⅜"=1'-0"
SECTION F-F
All structural work encased in concrete
Vertical Steel Sheet Piling
Sloping sheet piling driven in a vertical plane
ANCHORAGE DETAILS AT CORNER X
SCALE ½"=1'-0"
Existing Crib
MLW
For Pile Details and Pile Schedule see Drwg. No. 1-404
SECTION G-G
DETAIL OF CONTINUOUS DEAD-MAN
SCALE ½"=1'-0"
TYPICAL SECTION THROUGH NEW WALL AND CONCRETE DEAD-MAN
SCALE ½"=1'-0"
Rip-rap From corner V to 150'-0" beyond corner W
SECTION D-D
SECTION B-B
DETAIL OF SPECIAL CONCRETE BLOCK AT CORNER V
PLAN
SECTION C-C
DETAIL OF HOOKED BAR
48 Piles P8
Corner X
Notes: For East End of Section No. 5 of Sea Wall see drawing No. 1-408
SEA WALL SECTION No. 5
PROCUREMENT DIVISION PUBLIC WORKS BRANCH
U.S. IMMIGRATION STATION ELLIS ISLAND, NEW YORK HARBOR, N.Y.
1-407

Figure 44. Section No. 5 drawing, November 6, 1911.

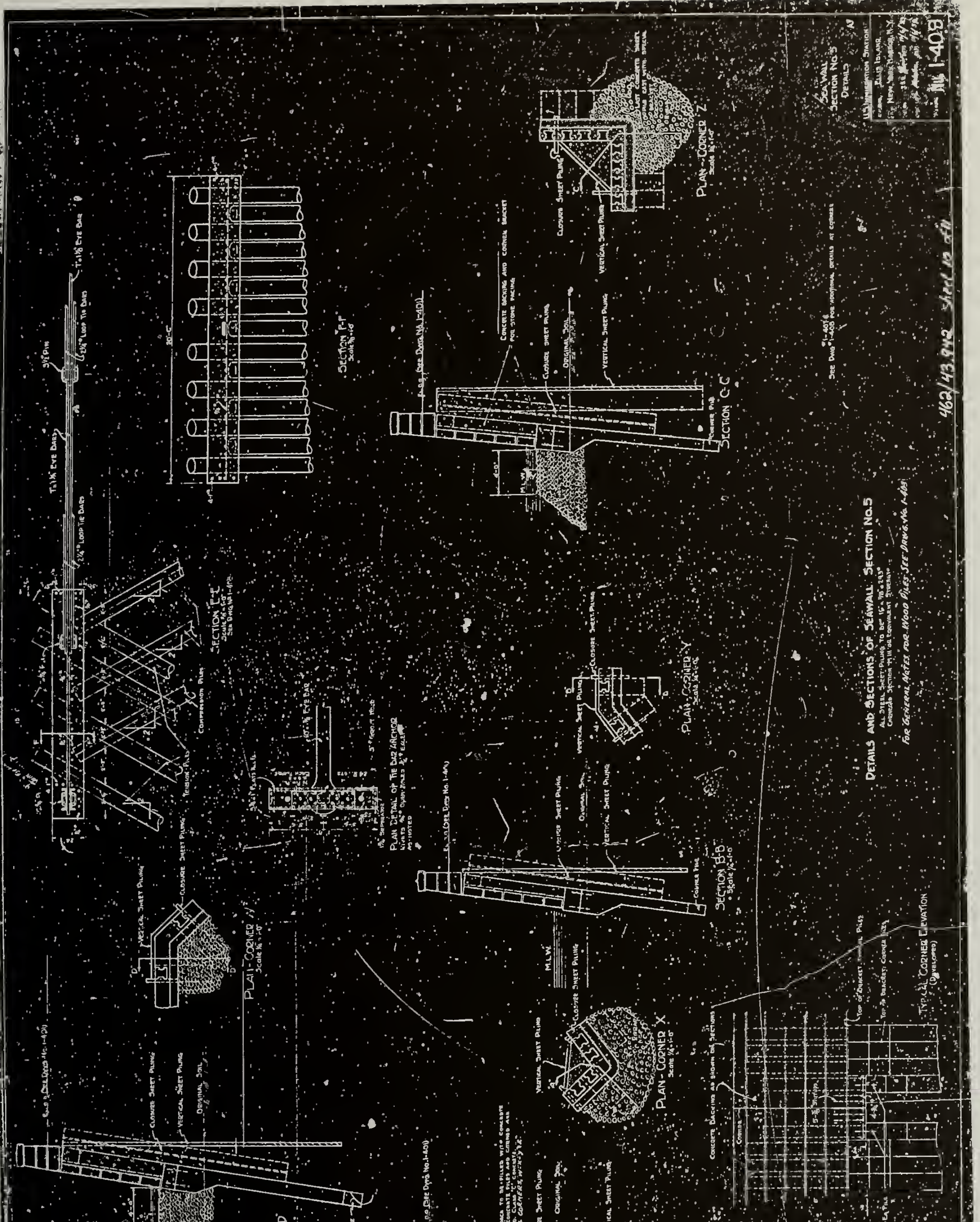


Figure 45. Section No. 5 details, November 6, 1911.

MAINTENANCE AND REPAIR: 1976 - PRESENT

In the 1976 condition report commissioned by the park, two principal causes of structural failure in the seawall were found. One was the partial to complete deterioration of the concrete behind the granite facing stones in the original 1913- 1921 wall sections; this was caused by chemical reaction with the seawater, tidal and wave erosion, freeze- thaw cycling, and the presence of numerous pour joints. The second was the opening of joints between the concrete sheet piles in the 1934- 1935 wall sections, caused—the report speculated—by careless installation.[33] These conditions resulted in the instability of the wall itself, leading to the loss of granite blocks, and in the loss of fill from behind the wall, leading to sinkholes around the island perimeter.

No documentation of the extensive work carried out in conjunction with the 1987 seawall rehabilitation could be found. About half of the seawall—3,400 linear feet—was reportedly treated, but there is no record of the locations of treatment. From the specifications, it may be speculated that the work consisted of grouting the open joints in both the 1910's concrete footing and in the 1930's concrete sheet piles, repointing and regrouting the granite facing (following cleaning by pressure washing), and resetting the loose stones. A portland cement- based grout was used, and was probably both pressure- injected and hand- packed.[34] The existing project specifications either represent a preliminary draft, or were not carefully followed. This is based on the fact that apparently neither the excavations (a linear trench along the wall measuring 6 feet by 15 feet), nor the filling and compaction that was specified to preempt any incipient sinkholes, were undertaken.[35]

The 1997 work on the seawall along the south side of the ferry slip consisted of resetting the fallen stones with steel pins where the iron anchors had been, blasting the back stone surfaces with a coal- slag air abrasive, and injecting grout behind the wall. A mixture of grouts that were hydraulic cement- based and calcium- free were used. Made by Specon, Inc., these were Powergrout ™ (slower- setting) and Powerplug™ (faster- setting).[36]

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[33] URS/Madigan- Praeger, p. 3. In the construction photographs, the installation of the sheet piles appears to be careful and regular (figs. 36- 37).

[34] *Project Manual for Docking Facilities and Seawall Repair, Ellis Island, Statue of Liberty National Monument,* Beyer Blinder Belle (New York: September 22, 1987). Statue of Liberty /Ellis Island Library.

[35] Correspondence (e- mail) between Richard Holmes and John Pousson, June 16, 2003.

[36] Conversation with Peter O'Dougherty, Ellis Island Facilities Manager, May 2003.

MORTAR

All bedding and pointing mortar for the granite facing stones was specified to consist of portland cement and sand only, in a 1: 3 mix for the first and third contracts (1913 and 1918), and a 1:2 mix for the rest of the contracts, including the 1933- 1935 wall sections.[37] The sand was to be sharp and varied in size up to an eighth of an inch. The only section of original mortar that remains today is in the parapet wall in front of the Ferry building, dating from 1934. All other original mortar was removed during the 1940's and 1987 repointing.[38] It is probable that the repointing mix used in the 1940's was similar to the 1:2 portland mix used for the 1933- 1935 seawall construction, since the latter had been accomplished fairly recently, and the repointing would have had to match the existing wall sections.

The bedding mortar in 1987 consisted of a 2:1:9 mixture of portland cement, hydrated lime, and sand, and the joints were pointed with Speed Crete joint grout or an equivalent.[39] Mortar analysis was not undertaken for this report, because only one of the original mixes survived, and the results would not have shed light on the primary historical or developmental questions about the seawall.

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[37] See Appendices C and D.

[38] Conversation with Peter O'Dougherty, Ellis Island Facilities Manager, January 2003.

[39] Beyer Blinder Belle.

PART IV.

RECOMMENDATIONS

With few exceptions, the structures used to expand and stabilize Ellis Island between 1890 and 1935 are still in place on the island. The lower part of the wooden cribwork infrastructure that contained the expansion landfill and that functioned as the island's first seawall in 1890- 1907 exists *in situ* below water and below grade. Most of the concrete and stone seawall that surrounds the island today, constructed between 1913 and 1935, was built either in front of or on top of this cribbing. Although specific recommendations for the seawall treatment are beyond the scope of this report, it is hoped that the main theme presented here—that of the chronologically and structurally layered nature of the seawall—will help to focus treatment decisions.

The treatment proposed for the seawall is rehabilitation. The Secretary of Interior's Standards for the Treatment of Historic Properties states that in rehabilitation, "historic building materials and character- defining features are protected and maintained, [but] latitude is given...to replace extensively deteriorated, damaged, or missing features using either traditional or substitute materials."[40] In the context of a historical engineering structure such as the seawall, additions to the existing system such as anchors or other elements that enable the structure to maintain its function are also given leeway for inclusion. Standard 9, however, adds the caveat that "New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property."

In selecting a specific rehabilitation strategy, a conservative approach to the maintenance of original structure and retention of original material is urged. It is important that the seawall construction from the island's history of expansion from 1890 through 1935 be preserved to the fullest extent possible. Preservation of the wood and masonry structures, both visible and buried, is important on several levels. First, the sequence of varied seawall construction preserves a record of the physical history of the island. The original wood cribbing, most of which exists *in situ* within the landfill of the island, is an archeological resource to be "protected and preserved in place. If such resources must be disturbed, mitigation measures must be undertaken" (Standard 8).

In the case of the wood cribbing, too, there is a structural necessity for taking a conservative approach to its rehabilitation. Although in varying conditions, the cribbing continues to retain the majority of the landfill for the island extensions. The masonry seawall was not intended to be a retaining wall for the entire island, but to function as a durable protective breakwater and "second front" of protection that retained smaller amounts of fill between it and the crib. Any stabilization measure addressing the washing- out of fill material must take into account the condition, structure, and placement of the wood crib. The crib's condition should be addressed where there are problems, and the areas that are in good condition should not be compromised in any way.

Finally, and more generally, the continuum of seawall structures preserved at Ellis Island is of value for its representation of engineering history at a time of rapid technological change, and should be preserved as such. The different phases of seawall construction illustrate a series of changing solutions for a large- scale marine engineering work, from that of a large- scaled timber construction, to that of a load- bearing concrete and stone wall, to that of a precast concrete assembly exploiting both the tensile and compressive properties of the material.

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[40] Kay D. Weeks and Anne E. Grimmer, *The Secretary of the Interior's Standards for the Treatment of Historic Properties, with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings* (Washington, DC: NPS, 1995), p. 63.

In summary, it is recommended that the design solution selected for seawall rehabilitation preserve the structure and materials of the original wood crib and masonry wall constructions to the fullest extent possible.

PART V.

GLOSSARY

Breakwater: a protective structure built from the seabed to protect an anchorage, harbor, or basin from wave action.

Bulkhead: a retaining structure or partition primarily intended to prevent land from sliding into the sea. A secondary purpose is to protect the upland against damage from wave action.

Crib: a massive box made out of interlocking wood beams that is filled with rocks ("riprap"—see below) for ballast and stability. A crib may function as a breakwater, seawall, bulkhead, and/or as an underwater foundation for building.

Cribbing, Crib Work: a crib wall along some distance, or an assembly of cribs.

Dredging: the excavation of the bottom of a water body using mechanical or hydraulic machines, often to provide sufficient depths for navigation or to reach a solid surface upon which to build.

Hydraulic Boring: an investigative technique in which a long sampling tube is forced into the harbor floor using hydraulic power and is then removed, extracting a cross- section of the below- grade material. Upon examination and analysis, an array of these sample cores will indicate bottom conditions that will be encountered during dredging and construction, including the depth below mean low water at which foundations can be constructed.

Mean High Water (MHW): average height of all of the high waters recorded at a given place over a 19- year period. For shorter periods of observations, corrections are applied to eliminate known variations and reduce the results to the equivalent of a mean 19- year value.

Mean Low Water (ML W): average height of all of the low waters recorded at a given place over a 19- year period. For shorter periods of observations, corrections are applied to eliminate known variations and reduce the results to the equivalent of a mean 19- year value.

Riprap: stones of varying sizes placed in cribs for fill and ballast, or behind cribs for crib stabilization. In some areas of the seawall, riprap was also used a protective mound around pilings upon which a wall foundation platform was built.

Seawall: a massive structure built along a portion of the shore to prevent erosion and other damage by wave action. Often functions as retaining wall for earth against its shoreward face. Generally more massive and capable of resisting greater wave forces than a bulkhead.

PART VI.

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PART VII.

APPENDICES

APPENDIX A.

Specification for the Construction of Island One

From Box 601, Entry 8, RG 121, NARA II

SPECIFICATION

For Building Cribs for United States Government at Ellis Island, New York Harbor.

Plans to be seen at the Office of

Superintendent of Repairs,
United States Public Buildings,
Room 104 Court House and P.O.Building,
New York, June 5th, 1890.

The amount of work to be done, the size of different Cribs, and the lines that they are to be built on, will be entirely in accord with the plans accompanying these Specifications.

Bidders must satisfy themselves by personal examination of the locality, or whatever means they may prefer as to the accuracy of the soundings and shall not at any time after the submission of their estimate, dispute or complain of any misunderstanding of the Specification or Plans.

The Contractor will be obliged to complete the work to the entire satisfaction of the Superintendent of Construction, and it is to be expressly understood, that no deviation from the Plans or Specification will be allowed in any respect whatever, except by written consent from the Superintendent, when he deems such alteration necessary for the best interest of the Government.

The Superintendent of Construction shall have the power at all times to reject any work that he does not consider in strict conformity with the Plans and Specification.

The work to be done under this Contract is to be commenced within five days after the date of contract, and to be finished on or before the 25th day of October, 1890. And the damages to be paid by the Contractor for each day after the time for fulfillment of Contract has expired will be($50) Fifty Dollars per day.

Bidders will submit a price for the whole work, and will give Bonds for the faithful performance of the Contract in the sum of

M[illegible]n Crib.

The Main Crib on the Southerly side of the Island, beginning at the shore and extending as described on the plan, will be built in the following manner:

It will be twenty-two feet wide on the bottom and eighteen feet wide on the top, and will be sunk twelve feet deep, below mean low water, excavated by the Contractor to receive Crib.

Lower Portion of Main Crib Frame.

Crib will be framed on eight courses of longitudinal sills of 12" x 12" yellow pine, placed at equal distance so as to cover full width of the Crib, running its entire length.

The bottom timbers or framing logs in these sills will be in lengths of not less than thirty feet, except end lengths, which may be shorter if necessary, and where lengths join, to be scarfed with two feet six inch scarfs, rew bolted together with four 3-4" x 14" iron screw bolts nut and washers.

On top of these longitudinal sills, a course of cross sills will be laid at intervals of every six feet. They will be of round spruce logs of sufficient length to reach the full width of Crib in single piece- let down to the under under sills, ~~[illegible]~~ four inches at each crossing and fastened to the under sills with 3-4" x 18" iron dock spike.

Floor. On top of the cross sills, a close floor of round logs will be laid longitudinally, they are to be of straight pine or spruce, not less than 6" at small end and in lengths of not less than forty feet, except the end logs to finish a course. These logs will be laid with butt joints to come only over the center of the cross sills, and to break joints in a proper manner. Each floor log to be fastened at each crossing to the sills beneath with 5-8" iron dock spike, long enough to penetrate at least 8" into the sill beneath. Where floor logs butt, they will be spiked with 5-8" iron dock spike of sufficient length to penetrate the under stick at least 8".

These floor logs are to be notched down at each bearing to the sills beneath.

Braces. On top of the floor, a row of transverse braces will be laid at intervals of every six feet. They will extend the full width of the Crib, in single lengths, and be not less than 8" at the small end, spiked down to the floor every five feet with 3-4" iron dock spike of sufficient length to penetrate at least 6" into the under stick.

Above the row of transverse braces, a row of longitudinal braces will be laid. The front and rear rows will be double logged, and the intermediate rows (single) placed a distance so as to form five feet square bays with the transverse braces. They are to be notched down, and fastened to the transverse braces beneath with 5-8" x 16" iron dock spike, except the butts which will be fastened with 3-4" iron dock spike of sufficient length to penetrate under log at least 8".

These longitudinal logs are to be in lengths of not less than thirty-five and upward feet, not less than 6" at the small end, except the end where shorter pieces will be used to finish out the course. Where joined these logs will lap each other at least two bays.

From this course up to low water mark, the Crib will be built up of alternate courses of longitudinal and cross braces. Spaced, fastened and of the same size, quality and number as the first two courses heretofore described.

UPPER Portion of Main Crib.

From mean low water mark up to the grade required which will be about five feet above high water mark, to the top course of timbers, the main face of the Crib will be built up of courses of square sawed yellow pine of 12"x12" laid in lengths of not less than thirty feet except the end lengths to carry out the course which may be shorter. The bottom course will be laid upon a tier of transverse logs, which will be flattened to receive it, where lengths join in the bottom course.

This course will be fastened to each transverse log neath it with 7-8" x 20" iron dock spikes. Each course will be fastened to the course beneath it at distance of about six feet, with 7-8" iron dock spike 22" long. These face timbers will butt up squarely, butts to come only between the cross ties, and break joints in a proper manner. One bolt at each butt.

The balance of the Main Crib from low water up to the required height will be built up of alternate courses of longitudinal and transverse logs, placed, distanced and fastened in the same manner as described for lower portion of the Crib. The rear rows of longitudinal logs and the intermediate rows spaced so as to form bays with the transverse logs six feet square.

The longitudinal logs are to be in lengths of not less than 35 feet and upwards, 6 inches at the small end, where joining, they will lap at least two bays. The transverse braces will be placed every six feet. They will be in single lengths for the full width of the Crib and not less than 8 inches at the small end. These cross braces will be dovetailed into the face timbers. These dove-tails are to be not less than six inches deep and eight inches wide, and as much longer as the size of the stick will admit, or as the Superintendent of Construction may direct.

The dove-tails are to be properly cut, leaving square shoulders which will fit snug into the face timber. The dove tailed heads of the cross braces will be fastened to the face timbers with 1-2" x 12" iron dock spikes.

The main Crib from the flooring up to within one foot of the level of the under side of the backing log will be filled up with suitable sized stone, no stone to be larger than eighteen inches in its largest dimensions and with smaller stone to fill in the spaces.

The old Crib for a distance of (163) feet one hundred and sixty-three feet to be removed to low water mark by the Contractor, to make room for the new work, and face of present Crib to be close piled with 12 inch diameter at butt spruce piles and be driven to a depth of 15 feet below low water mark.

The balance of the Cribs consisting of the inshore Crib, running East and West, and connecting with present bulkhead. The Crib on the West side of the Island running North and South, and the outer Crib running East and West, and Crib on North side of Island, all as described and shown on the plan accord-ing to the measurements and sizes thereon, must be built in exactly the same manner as heretofore described for the Main Crib.

All the materials to be of the same size and quality.

These Cribs will be sunk to level of Basin dredging 12 feet in depth below mean low water and 18 feet wide at bottom and 15 feet wide at top which will be excavated by the Contractor. The inshore Crib, or bulkhead, running East and West, will be built from low water mark up to the required height on its outer face with sawn yellow pine timber of 12" x 12". Also face in similar manner the inner face of the breakwater at southerly side of basin.

The Cribs on the Westerly, Northerly and Easterly side the Island will be built from low water up, from bottom to top of round spruce logs, same as main Crib with two sawn timbers 12 x 12 yellow pine at top fastened with the same size iron and in the same manner.

Mooring Posts.

There will be Mooring Posts along the entire front of the Crib in basin placed about 50 feet (fifty feet) apart as shown on the plans. These Mooring Posts will be of pine, not less than 16" diameter at the butt, well braced and checked to the backing piece with four (4) pieces of 6" x 10" yellow pine plank bearing against the hull of the posts and ties, and spiked thereto with 1-2" x 12" iron dock spikes.

The Mooring Posts are to be cut off and rounded on the head about four feet above the backing log, and to be painted with two coats of white lead and linseed oil, and to be placed close to string piece.

Half Round Fenders.

A half round white oak fender, not less than 5" x 8", 12 feet long will be placed each side of each row of braceheads, properly fastened to the face timber with six 3-4" iron dock spikes 12 inches long. They will be neatly trimmed off even with the top course of face timbers.

Outer Corners.

The two outer corners of the Cribs will be close fendered with four inch white oak plank, not less than 12 feet long, for a distance back of 8 feet on each side of a corner, each plank to be placed vertically, and secured to the face timbers with 6 3-4" x 12" iron dock spikes.

There will be three corner bands placed on each corner, They are to be 3-4" x 4" first quality of wrought iron five feet on each arm, secured with eight 3-4" , and 12" long round iron dock spikes, counter sunk heads to each band.

ality of
mber.

All timber used in the work will be of new sawed yellow pine, entirely free from wind shakes, decay, knots and other defects injurious, in the opinion of the Superintredent of Construction, to its strength or duribility.

The cross sectional area of sap, or wane, or of both combined, must not exceed two square inches.

All timber must be of first quality in every respect, and what is known as North Carolina Yellow Pine will not be accepted as yellow pine under this contract.

All scarfs and joints must be accurately fitted, equal to in all respects to first quality of Bridge building. No blocking or shinning pieces will be allowed to make good joints.

All work to be done under these specifications, must be to the satisfaction of the Superintendent of Construction and all material and workmanship shall be subject to the inspection and rejection of said Superintendent.

Fender
Piles

At the Easterly ends of Crib work and corners, there must be driven oak fender piles not less than 5 in number, and 30 feet in length and not less than 13" at butt. Piles similar in diameter must be driven at intervals of 20 feet along the entire outer face of the Crib work, and inner face of breakwater crib.

All fender piles to be striped of bark and securely fastened [illegible] ces of Crib. Also chock all fender piles by wooden chocks, 12 x 12 x 5 feet in length well bolted to face of dock, with 4 3-4" iron bolts, 20" long. All fender piles ~~mu~~ must be cut to a uniform height of five feet above top of string piece.

These piles must be sound and straight and not less than six inches at the small end. Care must be taken in driving piles not to split same.

String Pieces.

String pieces of 12" x 12" sawed yellow pine timber in lengths not less than 30 feet, except where required closer will be placed on top of Crib its entire length on outer face of bulkhead and breakwater and ends of entire Crib work, they must be half lapped at joints not less than 24 inches long each joint, and will be fastened to timber beneath them by two 7-8" x 22" dock spikes and also by a similar spike at every six feet between joints.

Bracing.

Brace the string pieces at corners by diagonal braces of 12" x 12" yellow pine dove-tailed in and fastened at each end by two dock spikes of proper size.

Flooring and Sleepers.

Provide yellow pine floor timber not less than 3" x 10" in width and thickness, and spike same at proper intervals, to sleepers of yellow pine 6" x 12", these sleepers to be framed in and fastened in approved manner, and extend a distance of 6 feet apart from centers, 40 feet from face of bulkhead of Crib work, towards the building line, and beyond same at either end.

In rear of Crib there will be two longitudinal rows of bearing piles of spruce, 12" at butt and six feet from centers, each row to be capped longitudinal with 12 x 12 yellow pine joists, to be scarfed with 2 feet scarfs, and bolted to heads of piles with one 7-8" x 22" dock bolt. A Ranger to be placed every six feet and bolted to Crib and capping with 3-4" x 20" bolts to each crossing, a decking of 3" yellow pine spiked at each crossing with one 7-16" x 7" spike.

Return to be floored as above in similar manner, and crib work running at right angles with Main Crib at East end of Island, to be floored in similar manner, or as above described.

Wrought Iron

All wrought iron used must be of best quality, and capable of being bent over a cylinder 2" in diameter.

The Contractor to carefully examine plans and to read these Specifications and note any omission (if such exist) and to notify the Superintendent, before signing of Contract.

During the prosecution of the work, the Contractor shall place proper and sufficient safeguards for prevention of accidents, and shall place signal lights every night, as many as may be required, and be responsible for all damage arising from neglect of taking proper precautions to prevent accident.

Finally.

It is intended and fully understood that the work is to be completely finished according to the true intent and meaning of the several drawings and specifications, and any work designated on the plans and drawings and not included in this specification, or vice versa any extra charge.

All to be finished in conformity with the general style of work.

SPECIFICATION

for

DREDGING AT ELLIS ISLAND, N. Y. HARBOR.

---:o:---

The dredging to be done under this contract, embraces the removal of all material other than solid rock, including all mud, sand, shells, clay, gravel, loose stones, and old cribs from low water, to a depth of 12 feet, or to a level bed below mean low water. The area to be dredged over, will be in accordance with the line furnished by Superintendent of Construction, and in accordance with the plans on file, in the office of said Superintendent.

All material dredged will be paid for by the cubic yard, measured in the scows, or basins to be filled, and any material not measured before removal will not be paid for.

Contractor is to fill the inner basin formed by present bulkhead, and new cribwork north, east and west of same, with hard material dredged from channel and main basin, or obtained from city by scows, to level of dock floor, and dredging must begin at easterly and westerly ends of present bulkhead, and inner face of same and continue to intersection with crib, running north and west, at each end of Island at right angles with southerly front of bulkhead, and the continuation of same.

The contractor for dredging must level up the earth filling at completion of cribwork and flooring to height of floor; also place additional earth or sand to surface level ase of washout or settlement. The entire area of re- aimed basin to be covered with 3 feet in depth of clean sand, or loam, below surface level of Dock or Island, contractor for dredging to provide same.

ap Immediately in rear of cribwork on southerly side and east end of Island provide and place not less than seven hundred and fifty tons of stone rip rap filling, the same to extend the entire length of bulkhead, for purpose of resisting pressure of earth filling, in basin.

Rock. In case rock be found in dredging channel and basin, the same must be removed by blasting, at a cost not to exceed ($4) four dollars per cubic yard, and to the depth specified, viz: 12 feet at mean low water.

Surplus filling of every description to be removed seaward, in accordance with the law, and material not so disposed of, will not be paid for.

It is intended and fully understood, that the work is to be completely finished, according to the true intent and meaning of the several drawings, and specifications, and any work designated on the plans or drawings and not included in this specification, or vice versa, is to be done without any extra charge.

APPENDIX B.

Specification for the Construction of Island Three

From File 51447/41 2B, Box 36, RG 85, NARA I

SPECIFICATION FOR THE CONSTRUCTION OF AN ISLAND AND A CERTAIN GANGWAY IN NEW YORK HARBOR, NEAR ELLIS ISLAND.

1. CHARACTER OF THE WORK. It is the intent of this specification to provide for the complete construction in first class manner of an island (hereinafter termed HOSPITAL ISLAND-, with crib bulkheads and necessary dredging and filling, and also a gangway connecting such new island with the present extension to Ellis Island, at a point in New York Harbor southwesterly from Ellis Island; the location, character and description of which work are shown by Plans Nos. 1, 2, 3, 4 and 5, copies of which are hereto annexed; such island, when constructed, to be suitable for immediate use for any of the purposes to which similar land is usually put. The work will from beginning to end be subject to the inspection and approval of such person as the Secretary of Commerce and Labor shall designate, and unless notice in writing to the contrary be given such person will be the Chief Engineer and Superintendent of Construction, Repairs and Maintenance, under the Treasury Department, hereinafter referred to as the Chief Engineer.

2. LOCATION OF HOSPITAL ISLAND (with the exception of tongue of breakwater crib 25' x 25' which shall be located as shown on plan and dredged for and built by contractor as generally specified). This new island will cover the area described as follows, reference being had to Plans 2 and 4: Beginning at stake numbered 1, distant 225 feet from southeast end of Ellis Island extension and set about south 56 degrees west from said end; running thence from stake numbered 1, at right angles to the axis of Ellis Island extension

about south 56 degrees west to the stake numbered 2 set 250 feet distant from stake numbered 1; running from stake numbered 2 parallel to said axis about north 35 degrees west to the stake numbered 3 set 800 feet distant from stake numbered 2; running from stake numbered 3 at right angles to said axis about north 56 degrees east to the stake numbered 4 set 250 feet distant from stake numbered 3; running from stake numbered 4 parallel to said axis about south 35 degrees east to stake numbered 1 set a distance of 800 feet from stake numbered 4. The outer boundaries of said hospital island are to be straight lines formed by the several faces of cribwork hereinafter described.

The location of said island is now indicated approximately by stakes bearing small red flags. Its area (exclusive of tongue crib) will be about 4 6/10 acres.

3. MEASUREMENTS, SURVEYS, ETC. The contractor must take his own surveys and soundings and run his own lines for the work, and he will be held responsible for any inaccuracies in such surveys, soundings or lines in any way affecting the work, (including its character or location).

The decision of said Chief Engineer as to measurements and soundings in connection with the work shall in case of dispute be final.

4. DREDGING FOR CRIB WORK. Along the boundaries of said Hospital Island there shall be dredged a trench adequate to properly receive crib work as specified and of a width of about 28 feet at base after allowance for caving of trenched sides according to nature of the bottom. Such trench shall be dredged to a uniform depth of 15 feet below mean

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low water, but if at such depth said Chief Engineer is not satisfied with the character of bottom, dredging shall continue until he is satisfied therewith. In no event, however, will a depth of trench greater than 22 feet below mean low water be required.

Bidders will state on proposal sheet annexed at what price per cubic yard, scow measurement, they will perform such additional trench dredging below said depth of 15 feet. Bottom of dredged trench must be left level and free from projections or stones.

The term "dredging" includes the removal of all mud, clay, sand, gravel, shells, loose stones measuring under 2 cubic feet, old logs and other similar matter, and of all material other than boulders measuring over 2 cubic feet, solid rock or old wrecks.

Should it become necessary to remove either boulders measuring over 2 cubic feet, solid rock or old wrecks, said Chief Engineer will allow for such removal such additional amount as he shall deem reasonable and proper.

4a. POSSIBLE BASIN DREDGING. The Secretary of Commerce and Labor reserves the right to require that the contractor to whom the contract for construction of said Hospital Island is awarded, dredge as may be necessary in proposed new basin or slip between said Hospital Island and present Ellis Island extension shown on Plans numbered 2 and 4.

Dredging in this basin, if required, will be paid for at a unit rate per cubic foot of scow measurement to be stated by bidders under item 4 of proposal sheet annexed

in relation to "Possible Basin Dredging".

Bidders may assume that said basin dredging, if required, will be in soft material, that present depth of water over site of proposed basin ranges from 3 feet to 4 feet 6 inches at mean low water, that no basin dredging will be required in depth of water exceeding 15 feet below mean low water, and that the quantity of soil to be removed will range from 18,000 to 54,000 cubic yards, scow measurement. Paragraphs 4a and 5 will so far as applicable, generally govern any dredging work that may be required.

5. TIME TO COMPLETE DREDGING. Said trench must be dredged and completed to a depth of fifteen feet below mean low water and a width of about twenty-eight feet within ninety days after receipt of notice of execution of formal contract based on the accepted proposal. Should further trench dredging be required said Chief Engineer will allow therefor such additional time as he shall deem reasonable.

6. DISPOSAL OF MATERIAL. All dredged material must be disposed of in accordance with the laws of the United States and of the States of New York and New Jersey, and with the ordinances of the City of New York, and no material disposed of contrary to the provisions hereof will be paid for. Any unlawful disposition of material will subject the contractor to the penalties provided for in such cases. Such portion of the dredged material as in the opinion of said Chief Engineer shall be suitable for filling may be used for this purpose and dumped at points to be indicated within said boundaries of proposed Island, provided that such material shall first have been inspected and accepted. Any such material used for

filling without such inspection and acceptance must upon request be removed at contractor's expense.

7. PLACE AND CONSTRUCTION OF CRIBWORK. Cribwork must be built at or near the site of the work. Bidders may, however, state at what deduction they will build same at some other stated point, thereafter rafting or towing same to Ellis Island. No place of construction will be accepted where inspection will be inconvenient or impracticable.

8. CONSTRUCTION OF CRIBWORK. The face of the side crib bulkheads and the end cribs must be accurately set and built on the established bulkhead lines above described and shown on plan. The construction of the cribwork must be so pushed as to prevent said trench from filling before the setting of the cribwork, and should such filling occur the same must be removed by contractor.

9. GENERAL DESCRIPTION OF CRIBS. The side crib bulkheads shall be 800 feet long on top of outer faces from end to end, 20 feet wide on top of crib, and of width required on bottom by batter specified. The end crib bulkheads shall be strongly fitted in the best manner to side crib bulkheads and shall extend at right angles connecting same as shown on plan.

Contractor may at his option leave during construction at convenient points two entrances 30 feet wide into area formed by crib bulkheads described, in order to faciliate the dumping of filling from scows. After dumping of such filling said entrances shall be filled with timber construction, as generally specified, and in such manner as not to weaken integrity of crib where openings have been left and filled.

The end cribs fitted between side cribs shall be 20 feet wide on top and of such length as to give a total width of 250 feet over all to island area, exclusive of tongue breakwater crib.

The new side and end crib bulkheads shall be built throughout level to conform to bottom.

The cribs shall be constructed as shown by drawings in four blocks. They shall be built up so as to bring bottom of the backing logs 7 feet above mean high water when work is completed. The front face of cribs shall have a batter of 2 1/2" to the foot below mean low water and a batter of 1" to the foot above mean low water. The rear of the crib shall be vertical.

The total depth of crib required by this specification shall be 27 feet from top to bottom. Should a greater depth be required for any section of crib, contractor will be allowed a unit rate for crib built as specified per cubic foot for each additional foot required. He will state in his proposal sheet his unit price for each cubic foot of extra crib, filled and in place.

10. LOWER PORTION OF CRIB. The first full bottom course of crib shall consist of round logs, placed longitudinally of the crib in five rows, one at the front, one at the rear, and the other three spaced equally between. The front rows shall be double, with a proper break of joints. On these rows of logs round log ties shall be placed transversely of the crib, running from front to rear in single lengths and spaced vertically over each other about 8 feet, centers, longitudinally and properly notched down upon the lower logs.

From these ties up to mean low water mark the cribs shall be similarly built up of alternate longitudinal and transverse

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the foot as shown on drawing and as directed.

11. UPPER PORTION OF CRIB. From mean low water mark the front faces of the side cribs and end cribs shall be built up to the grade previously given, i. e., 7 feet above mean high water, with square sawed yellow pine timber laid close on lengths of not less than 32 feet, except where required to close in at the ends.

The backing logs and bottom of all front faces to be of 12" x 12" timber and intermediate courses of 10" x 12" timber laid flat, except that the course next to backing log may be of height required to bring backing log up to said grade. The bottom course of 12" x 12" timber to be in lengths of about 28 ft., joined with scarf joints 4 ft. long coming about half way between the cross ties, each fastened with two 1" x 14" screw bolts, with heads and washers countersunk in the top of the timber.

The bed timber of bottom course to be dressed from 1" on one edge to nothing on the other in order to give proper batter to the other face timbers, as they are laid up.

The face timbers must hbutt squarely and only at about half way between the cross ties. They shall be fastened at each end and to the timber under them at every four feet with a 7/8" by 20" dock spike for the 12" x 12" timbers, and by 1/8" by 18" dock spike for the 10" x 12" timbers.

In rear of facing above described the crib shall be built up of alternate courses of longitudinal logs in four rows, spaced at equal distance from front to rear and of round log ties, single lengths, running transversely of the cribs, from front to rear, about 8 feet centers vertically over each other and over round log ties in lower part of crib.

12. CRIB-DOVETAILS. The log ties shall be done-tailed into facing timbers of the cribs and notched down upon the logs under them.

These dovetails shall be not less than 8" wide by 6" deep and shall be as much larger as size of timber will permit. Dovetails are to be neatly cut leaving square-cut sawed shoulders on the ties to fit up well against the face timbers.

13. CRIB-ANGLES. At the angles in the cribwork where the side cribs and ends join, the facing timbers shall be half-lapped together. This applies also to construction of tongue crib.

14. SIZE AND FASTENING OF CRIB LOGS. All logs in crib below mean low water shall be of spruce, pine, or cypress, and sound and straight. The cross ties above mean low water shall be not less than 10" in diameter at the small end. Below mean low water they shall not be less than 8" in diameter at small end.

The longitudinal logs shall be in lengths of not less than 50 feet except at the ends where required to close and except for the double logs in the face of crib below water where they may be not less than 48 feet long and not less than 6" in diameter at the small end.

At their joints except for the front double row the logs shall pass each other by the space of one bay and the joints be properly broken.

For the front double row the longitudinal logs shall butt against each other in each line, the butts to come only between the cross ties and to be arranged to break joints.

Each longitudinal log and each tie below low water must be spiked to the log on which it bears, using one 3/4" square dock spike from 15" to 20" in length according to thickness of log.

Each tie above low water must be spiked on each bearing on the longitudinal log by a 7/8" by 18" square dock spike.

The dovetailed ends of the ties must be fastened to the facing timbers with a 3/4" by 16" dock spike. The small ends of the crib logs to be bored for spikes as directed.

15. BOTTOM FLOORING OF CRIBS. On top of the second full course of longitudinal logs from the bottom of both the side and end cribs a close flooring shall be laid transversely of logs not less than 8" in diameter at the small end, each flooring log shall be fastened at each bearing with a 3/4" square by 16" to 20" dock spike and shall be in single lengths. Each longitudinal log in the course bearing on the floor shall be spiked once in every 8 feet with a 3/4" spike.

In alternate bays of both the side cribs, as directed, the floor will be omitted. In all other cases the floor logs to extend from front to rear of cribs and be single lengths. All bays in both end cribs are to be floored, also entire area of tongue crib.

16. BOXES FOR SEWER PIPE. Four square boxes 24" inside measure strongly constructed of spruce 4" thick must be built into the cribs or between two sections of crib work on southwest front for running the sewer pipe. These boxes must be placed where directed and at required depths and grade. They will be required to discharge at about mean high water.

17. END CRIBS. The end cribs at northerly and southerly ends between side cribs must be framed, floored, fastened and filled, all in manner as specified for side crib bulkheads; save that all end crib bays must be floored and filled. The cross ties of the side cribs shall extend in single lengths to rear of end cribs and the longitudinal logs of the end cribs be in single lengths. The facing timbers of the end cribs at northerly and southerly ends shall be half-lapped to the facing timbers of the side cribs and properly fastened to same.

The points of juncture of side crib bulkheads, and both end cribs shall be as well fitted, strongly built and secured as any other portion of the crib work.

18. TONGUE CRIB. In location shown on plan and as generally specified for side and end cribs and properly tied into northeast side crib at southeast end thereof, contractor shall construct and set in trench to be dredged by him as specified a tongue crib, in order to guard, as a mooring place, the northeast front of hospital island. This crib to be 25 feet by 25 feet and is to have square timber fronts as described for remainder of cribwork on both faces and ends.

The cross ties for this tongue crib must be of full size, as heretofore specified, and continuous from one face to the other face of said crib; both ends of ties to be dovetailed into square face timbers of said crib; the longitudinals shall be dovetailed into face timbers at end of tongue crib and shall be of sufficient length to be lapped back into main or northeast front crib.

A sluiceway about 5 feet in height and about 3 feet in width, planked top and bottom and sides with 3" yellow pine plank, shall be constructed parallel to face of northeast crib

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and run from side to side of tongue crib; bottom of said sluiceway to be set at about mean low water mark; this to prevent accumulation of drift in dead corner formed by tongue crib.

19. FILLING FOR CRIB BULKHEADS. The cribwork of both the side cribs and the two end cribs shall be filled from level of hard bottom or of crib flooring to within four inches of backing log with suitable sound stone or portions of old brick work, provided that no brickwork or stone injured by action of fire shall be used for filling or ballast.

The stone or brick filling required must be in pieces not over 18" in their largest dimensions for the floored bays of crib and return, and small stones must be used to fill up solidly as possible the voids or spaces between the larger stones.

The stone filling as provided for shall be brought up to level of backing log with about 4" of small quarry chips or coarse clean beach gravel.

The unfloored bays of the front crib shall be filled as provided for the floored bays, the filling or ballast being allowed to sink to the bottom. For these unfloored bays pieces of old masonry and stone may be used and from the bottom up to mean low water mark, pieces of masonry or brickwork not over three feet in their larger dimension may be thrown in. The unfloored bays into which this material may be dumped will be indicated. They will be so selected as to secure uniform use along the cribwork of stone filling.

The unfloored bays shall be chinked with small stones and topped with 4" of small quarry chips or coarse, clean beach gravel as provided for the floored bays.

20. FENDERS FOR CRIBS. There shall be a half-round white oak fender placed on each side of the exposed ends of the ties of the face timber of the crib and return as shown on the drawing, to be about 8" at butt end and about 6" at small end, 10" flat face and 12 feet long; tops of fenders to be flush with top of backing log, and to be fastened thereto and to face timbers with eight 3/4" x 16" dock spikes staggered down fender face to low water mark. These fenders shall have their heads and 6" below the same painted with two coats best white lead and oil as soon as fitted.

21. BACKING LOGS FOR CRIBS. Backing logs of 12" x 12" yellow pine timber in lengths not less than 30 feet except the end lengths to close, shall be placed on top of the facing timber of the crib bulkhead and return.

These backing logs shall be half-lapped at their joints and at the corners of the crib and shall be fastened to the timbers under them by two 7/8" square by 20" dock spikes at every point, and with 1" x 30" dock spikes every 10 feet in length.

22. MOORING POSTS IN CRIBS. There shall be forty-four (44) mooring posts in the cribs placed about 50 feet apart, as shown on drawing, about 14 feet long, spiked to adjacent ties with 7/8" square by 29" dock spikes and still further fastened by three chocks of 6" yellow pine plank bearing against head of post and ties, and spiked thereto with 3/4" by 16" dock spikes and by chocks of 12" x 12" 4 feet long yellow pine on each side of post spiked to backing log with three 7/8" x 22" spikes to each chock.

These mooring posts shall be yellow or Norway pine, not less than 16" in diameter at butt; they shall be stripped of bark above backing log line and have their tops smoothly rounded. Posts where projecting above crib shall receive two coats of white lead and oil.

23. FENDER PILES FOR CRIBS. At southeast, southwest and northwest corners of main cribs and at both outer corners of tongue crib five white oak fender piles shall be driven with their heads chocked by 12" x 12" yellow pine, each fastened with three 7/8" square by 22" dock spikes; or the securing of these fender piles may be by bolts and 5/8" iron chain, or wire rope as directed. They shall be further fastened with 1 1/8" screw bolts having two backing logs and corner chocks with washers countersunk at both ends sunk in the wood. These fender piles shall have their tops neatly rounded, the bark removed above low water mark and piles and chocks receive two coats of white lead and oil.

Three suitable temporary fender piles shall be driven at each of the corners of gateways north and south left for entrances for filling, should contractor elect to use the same. These fender piles shall be drawn when directed prior to closing of gateway with section of cribwork.

The permanent oak fender piles must be driven to hard bottom or until ten blows of a 2500-pound weight with a fall of 10 feet will not drive the pile one foot. Such driving to be in all respects as directed.

24. ADDITIONAL FENDER PILES. Contractor shall assume that he will be required as a portion of his contract to drive at designated points on outer faces of cribwork herein described fifty (50) white oak fender piles, to be driven, painted and finished as required. These piles, like other fender piles, to be about 14" at butt, have about 8" points and be straight and sound. They shall be bolted through backing log and through face timbers of crib and shall be chocked by 12" x 12" yellow pine pieces, two pieces to each fender pile. Chocking pieces to be about 3 feet long with outer corners neatly rounded and spiked by 3/4" by 20" long spikes into backing logs or square face timbers of crib. Manner of chocking described can be seen on examination of fender piles on northeast side of present Ellis Island basin.

25. SCARF JOINTS. The scarf joints for the bottom 12" x 12" facing timbers heretofore specified shall be at least 4 feet in length, each scarf to be fastened with two screw bolts 14" long furnished with cast iron washers, washers to be countersunk into top timbers and scarfs to be additionally fastened with two 1/2" square by 10" dock spikes.

26. COUNTERSUNK HOLES TO BE PITCHED. All holes countersunk in the timber to receive bolts and washers are to be filled with melted pitch to level of timber face after bolts are in place.

27. QUALITY OF TIMBER. All timber used in any part of the work must be in every respect of best quality and full and close to the dimensions given. Unless otherwise specified it must be newly sawed yellow pine free from any defects injurious to its strength or durability, including windshakes, decay, knots, etc. The cross sectional area of sap must not exceed 2 square inches in any single specified cross section

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of any stick or piece. In sticks of timber 7" or less in least dimensions the sap must not show on more than one corner.

What is known as North Carolina yellow pine will not be accepted as yellow pine hereunder.

28. QUALITY OF FRAMING JOINTS OF CRIB TIMBER. All framing must be best quality of workmanship. All joints must be accurately fitted and equal in all respects to what is required for best quality of bridge building.

No blocks or shims will be allowed to make good joints. All timber and plank ends must be squared with saw. Axes must not be used for such work. All mortises and tenons must be finished with plane and chisel and accurately fitted. Countersinking must be done with coaking augur, not with ax or chisel. Holes must be bored for all spikes in yellow pine planking.

29. TARRING OF JOINTS. All scarfs, tenons, dovetails and mortises and other joints, pile heads siding of piles and beds for backing pieces and all places where one timber crosses another must be freely treated with Wilmington tar.

30. CRIB FILLING PIECES FOR GATEWAYS, OR OPENINGS, IF CONTRACTOR ELECT TO USE SAME. If contractor elect to use gateways described in section 9 hereof they shall, when directed, be closed by cribwork similar in design, material, dimensions and construction to the main crib and of depth required, as shown on plan, and as directed. They shall be secured to the end of the main cribs by ties and cross ties and attached and built into the designated ends of main cribs in such manner as to make gateway equal in all details of strength, durability and finish to main cribwork as previously specified.

31. QUALITY OF IRON. All wrought iron used in the work must be sound and free from defects and have a tensile strength of 50,000 pounds to the square inch of section with 25% of ductility.

All cast iron used must be sound, free from blows and other defects, with tensile strength of not less than 17,000 pounds per square inch of section. All forging must be free from overheating or other defects. Samples will be selected for testing from each lot of iron delivered and failure of samples will cause rejection of lot from which sample came.

32. BOLTS, SPIKES AND WASHERS. All dock spikes to have spiked points unless otherwise specified. Screw bolts to have countersunk heads. Diameter of round washers shall be 3 1/2 times the diameter of bolt. Patterns to be submitted for approval.

33. PAINTING OF IRON. The exposed surfaces of all iron bolts and washers must be cleaned of rust and receive two coats of red lead, one coat to be applied to iron after delivery of work and inspection, second coat to be given after iron is placed: If inaccessible it shall receive two coats before placing.

34. CLEANING. Contractor must leave surface of bulkhead level and free from rubbish or incumbrance of any description.

35. FILLING FOR WORK. (EXCLUSIVE OF CRIBS AND GANGWAY.) Entire area within crib limits shall be filled up level to grade required, i. e., to 6' above mean high water. (N.B. This is 1' below crib top the difference in grade being accounted for through loam to be furnished under a separate contract.)

Filling must be begun inside of faces of new bulkheads and extend gradually toward center of island. Contractor will not be allowed to form a mud wave which will endanger cribs. Contractor must furnish whatever amount of filling may prove to be necessary for a depth of crib from top to bottom not exceeding 27' as hereinbefore mentioned. It is believed that such amount will be about 120,000 cubic yards, but as to this, no representation is made. Such amount will depend on various circumstances, including the nature of filling used, displacement of mud, escape from crib interstices, etc. Contractor will state in proposal sheet at what figure per cubic yard for stone and at what figure per cubic yard for earth or other soft filling he will furnish any additional filling which may be necessitated through an increase in said depth beyond said 27'. (It is not likely that said depth will be exceeded.) Filling other than stone filling required under this specification shall be mixed filling satisfactory in character to said Chief Engineer, such as sand, earth, gravel, clay, old debris, and plaster. Coal ashes will be accepted if well compacted. No perishable material, including wood, street sweepings, garbage or vegetable matter of any sort will be allowed to be used.

In connection with filling operations required to bring newly constructed island up to grade specified, contractor shall remove from the Main Island, or the present Ellis Island extension, all spoil or excavated material now in designated banks located on Main Island heretofore named. The quantity of this spoil and its location will be shown to bidders on application.

36. TONGUE CRIB FILLING. Tongue crib must be filled with stone as specified for other crib filling from floor line or interior of bottom up to mean high water mark, above which point up to grade level, soft filling of the character described in the preceding section may be used.

37. MODE OF FILLING. Crib shall not be filled above high water mark until at least one-half of area within cribs is filled to that point, unless special permission to the contrary

be given.

38. GANGWAY TO CONNECT NEW ISLAND WITH PRESENT EXTENSION TO ELLIS ISLAND. Contractor shall construct a gangway as shown by Plan No. 5. It shall consist of three lines of white oak piles driven at right angles to axis of Ellis Island extension and extending a distance of 225 feet from said extension and parallel to the northwesterly end thereof, connecting said extension with hospital island.

Gangway referred to shall have a width of about 12 feet from outside to outside and shall have its supporting piles spaced six feet apart on centers, both across and longitudinally.

39. GANGWAY PILING. Piles shall be of the character demanded for other white oak piles required by this specification, have not less than 7 inch points and 12 inch heads, and be driven generally as required by Paragraph No. 23 hereof.

The pile heads shall be fitted for side timbers and deck stringers as shown by plan.

Piles must be accurately spaced and driven vertically.

40. GANGWAY CROSS-BRACING. Each set of three piles shall be cross-braced on one side as shown by plan, said bracing to consist of 4 by 10 inch yellow pine, through bolted by 3/4 inch bolts having hex heads and nuts and washers, bolts to be of sufficient length to permit the use of a cast iron washer under both head and nut; the face of bracing to be reversed on each alternate set of piles.

41. GANGWAY LONGITUDINAL BRACES. The longitudinal braces shall be in as long lengths as practicable, and shall consist of 2 by 6 inch yellow pine set and secured as shown on plan immediately beneath rail wheel guard. Side braces described to be securely spiked near top of each pile with 1/2 inch by 10

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inch dock spikes.

42. GANGWAY WHEEL GUARD OR TOP RAIL. The wheel guard or top rail shall be set in recess to be sawed in outside of pile head, said guard to consist of 6 by 12 inch yellow pine set on edge and to be spiked diagonally with 3/4 by 20 inch dock spike, care being taken to have wheel guard come square and true.

43. GANGWAY DECK STRINGERS. Deck stringers shall consist of 4 by 10 yellow pine set in inside recess of all outside pile heads and be spiked thereto with 1/2 inch by 8 inch dock spikes, spikes to be driven diagonally as shown on plan. Stringers shall also be spiked to central row of piles.

44. GANGWAY DECK PLANKING. The deck planking shall consist of 3 inch yellow pine plank in approved widths of from 8 to 12 inches. It shall be laid parallel with axis of gangway and spiked securely with 6 inch spikes to the deck stringers heretofore specified, care being taken to drive no spikes into tenons of pile head or into 6 by 12 inch wheel guard.

45. GENERAL CHARACTER OF GANGWAY WORK. All provisions of this specification relative to timber, finish of work and alignment of same apply to gangway construction, and in addition the 2 by 6 inch side braces and the 6 by 12 inch wheel guards together with upper surfaces and edges of deck planking must be planed.

46. PAINTING. Side braces and wheel guards shall be given two coats best white lead and oil paint over all visible portions, and all bolts, nuts, and washers shall be dipped while hot in hot asphaltum and allowed to thoroughly dry before fitting in the work.

47. BREAKWATER. If the small breakwater indicated on Plan No. 2 be required, this will be made the subject of a separate contract.

APPENDIX C.

Specifications for the Construction of Seawall Sections, Contracts 1- 5, 1913- 1920

From Files 558 A- G, Box 55640, Entry 9, RG 121, NARA I

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SPECIFICATION

FOR ALL LABOR AND MATERIALS REQUIRED TO CONSTRUCT SECTION OF SEA WALL AT THE U. S. IMMIGRANT STATION, ELLIS ISLAND, N.Y. HARBOR, UNDER "SEA WALL CONTRACT NUMBER ONE".

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GENERALLY:

Bidders must visit the site, inform themselves of all governing conditions, and include in their estimate all items of labor and materials and plant required or necessarily implied, that may be necessary for the entire completion of the work in accordance with the intent of this specification, whether specifically mentioned or not.

From beginning to end, this work will be subject in every detail to the inspection and approval of such person as the Secretary of the Department of Commerce and Labor shall designate, and unless notice to the contrary is given such person will be the Supervising Chief Engineer, U. S. Public Buildings, Port of New York, hereinafter referred to as the Chief Engineer.

This specification is intended to supplement the drawings, and, therefore, it will not be the province of this specification to mention any portion of the construction which the drawings are competent to explain, and such omission is not to relieve the contractor from carrying out such portions only indicated on the drawings; and should items be required by the specification not indicated on the drawing they are to be supplied, even if of such nature that they could have been indicated thereon. Any item which may not be indicated on the drawing or mentioned in the specification, but are necessary to complete the entire work, must be supplied in place. The decision of the Chief

Engineer as to the proper interpretation of the drawings and specifications shall be final.

Contractor shall give his personal supervision to the work or have at all times to act for him a competent superintendent qualified in this class of work, who is satisfactory to the Chief Engineer.

All apparatus, materials, labor, etc., shall be subject ~~in~~ every respect to the approval of the Chief Engineer.

As far as possible, the work must be conducted to avoid interference with public business.

Contractor will be held responsible for all damage resulting from any improper conduct of this work, and must make the same good at his own expense.

ENGINEER:

The contractor must employ a competent Civil Engineer and Surveyor to lay out the lines of the proposed sea wall and to establish the elevations shown on drawing, and called for by these specifications. The contractor will be held responsible for the accurate placing, leveling and alignment of his work, and the entire construction must proceed under the supervision of said civil engineer.

BENCH MARK:

The bench mark from which levels shall be taken is a small brass plate located on deck of the cribwork neer ferry house, and shown thus (X B.M.) on the plan

TIME LIMIT:

The time limit stated on the proposal sheet shall cover the time required for the completion of the work as specified. The summary of working days within which the work is to be completed shall include all days except Sundays and legal holidays.

The time limit stated for the completion of the work must be the shortest time possible. The contract will require that the work be carried on with a sufficient force of workmen, and a quantity of materials satisfactory to the Chief Engineer in order to insure its completion within the time stipulated.

SUB-CONTRACTS:

No work is to be sublet to any person, firm or corporation without the approval of the Chief Engineer.

TRANSPORTATION:

The contractor must land all materials necessary for doing the work, at the dock designated on the plan, making his own provision for transportation, landing and hauling to the site of operations.

Transportation without charge for his men will be furnished by the ferry steamer "Ellis Island" running between Barge Office dock, New York, and Ellis Island, leaving New York hourly and making round trips. All tools and materials must be transported at the contractor's expense, except such small tools and materials as may be carried readily by individual workmen.

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PAYMENTS:

The basis of payment will be at the unit rate per lineal foot of finished wall bid by contractor on proposal sheet, including backing log, bollards, gangways, etc., for that portion of finished wall installed.

Payments will be made monthly of 90% of the value of the work satisfactorily installed, as estimated by authorized representative of the Government, and payment of the 10% retained will be made when work has been completed and accepted.

INTENT OF SPECIFICATION:

It is the intent of this specification and drawing to describe and require the construction of a section of sea wall about 725 feet long, including all necessary dredging and mat foundation for said section, which is to extend along the southeast face of main island and form the northwest face of the ferry basin.

There will be required the construction of as many linear feet of said proposed sea wall as the present appropriation approximating $92,000. will permit, there being some reservation of funds for certain back filling not included in this contract.

DESCRIPTION:

For the under water construction the wall shall be composed of concrete blocks cast and seasoned in the air, together with a mat foundation of concrete bag work, and for the above water construction, or the upper eleven feet of the wall, a granite facing backed with concrete which shall be poured in its permanent location.

ALTERNATE PROPOSALS:

Bidders will be permitted to submit alternate proposals at a unit rate per lineal foot of finished wall based upon their own plans for constructing this section of wall. These plans may embody a modification of the type of wall shown and described herein, a modification of the method of construction for this type. or an entirely different scheme for accomplishing the desired end, namely: A retaining sea wall possessing the same factor of safety as that required by these specifications and plans with granite facing for the upper eleven feet thereof, in front of which dredging may be done to a depth of eighteen feet below mean low water without affecting in any manner the integrity of the construction. Such alternate proposals to entitle them to consideration must fully set forth by plans, specificatios, and description, the exact method to be followed in this specific instance.

Bidders must understand that the Department of Commerce and Labor is in no way bound to accept any alternate method of construction, but will consider such proposals if properly and intelligently presented; and recommendations for award will be based solely upon the merit and economy of such alternate proposals in comparison with the construction shown and described herein.

PLANT REQUIRED:

The contractor for this work will be required to use floating equipment which is fully capable of handling and

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setting the under-water concrete blocks shown on attached drawing, and satisfactory to Chief Engineer. All diving apparatus must be modern, and subject to approval of Chief Engineer. Concrete mixing plant must be of a steam driven type specifically approved by Chief Engineer. Gravity mixers, or continuous mixers will not be permitted. Contractor's shed for storage of cement, etc., must be ample in size, of neat appearance, rain proof and well constructed. Arrangements for storage and handling of materials, as well as the cast blocks will be subject to Chief Engineer's approval.

It is required that the concrete blocks specified be taken from easterly face of the island and placed in position by means of a suitable floating derrick and its tackle and gear, since to attempt to place said blocks from a railway laid along basin face or from a derrick working on top of present crib dock would probably result in the destruction or sliding movement of the old crib beneath.

TEMPORARY PRIVY:

The contractor must provide a suitable temporary privy, for the use of his workmen, to be placed where directed, maintained in a sanitary condition, and at completion of the contract remove and the premises left clean.

WATER:

Water from Ellis Island water main will be furnished contractor without charge when the main is in use; but if said water main is broken, or if for any cause an adequate supply for both the U. S. Immigration Station and the contractor, cannot be obtained from the main, the contractor must furnish all fresh water required for his plant and work at his own expense. The contractor shall connect to water supply system of the Island where directed by Chief Engineer. The use of salt water or foul water in mixing concrete will not be allowed.

SEQUENCE OF WORK:

Beginning at a point numbered 720 on the profile of borings, contractor shall start dredging operations and proceed in a northwesterly direction along the face of the present cribwork, on the main island side of the ferry basin to obtain a trench with a bottom width of not less than fifteen (15') feet, and at a depth of not less than minus 28.5, nor more than minus 30 feet as shown on the accompanying plan. Should, however, the bottom prove unstable for foundation work at the maximum depth above stated, the contractor will be directed by Chief Engineer to dredge to a greater depth until suitable foundation strata is uncovered. Payment for this additional dredging will be made at the unit price bid on the proposal sheet.

Having dredged a suitable trench and obtained a satisfactory foundation for approximately 100 feet from the point of beginning, the contractor shall proceed to lay the mat foundation for the wall by depositing concrete under water in jute or cotton bags, and setting the concrete blocks containing wood spiking blocks (later described) to receive the boundary angles forming a curb for the finished foundation. He shall then proceed to set these angles by precision instrument measurements to the

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required line and grade, properly shimming, fish-plating, and spiking them in rigid position. Then by depositing rich concrete through a "tremie" (or tube) he shall proceed to fill between these boundary angles, and screed the surface to a true and level plane.

In the meanwhile dredging shall proceed simultaneously with other operations.

After having obtained a section of this finished and levelled foundation above described, and after inspection satisfactory to the Chief Engineer, and after seasoning for a period of thirty (30) days, the contractor shall proceed to scour the surface of the foundation work by a hydraulic jet and immediately thereafter shall begin to set the under water blocks.

Dredging shall not at any time be carried on more than 150 feet in advance of the block setting.

Having set at least four of the under-water blocks, properly jointed by concrete bags rammed into the chain grooves to form a key, the construction of the upper eleven (11) feet of the wall is to be started as shown on the plan, and substantially in accordance with the following method, unless otherwise directed by the Chief Engineer.

The lowest course of rock faced stone shall be placed on top of the cast concrete blocks, and suitable forms for casting the upper concrete portion of the wall shall be placed and secured in an approved manner.

The first stone course shall be laid at extremely low tide or the forms shall be watertight and kept dry while depositing concrete.

The back of each stone shall be furnished with a lewis-hole and have driven therein an iron wedge. There shall be hooked into a hole bored in the wedge two pieces of 3/8" round iron, which shall pass through to the back of the form and be there secured by bolt and washer. Before depositing concrete, not more than two courses of stone shall thus be placed and held by rods, and by any necessary end bracing for each block.

Cramp irons or ties securing the rock face stones to concrete shall be placed as shown on the plan as the courses are laid, a clearance for the iron ties to rest in being cut in the top of each stone.

Contractor shall proceed to fill the upper part of the forms with concrete and lay and bed the facing stones with cement mortar joints, as specified, repeating this process course by course, until the capstone of the sea wall is placed. New concrete joints, occurring when construction is stopped from day to day, must be provided with keyways formed by 4" x 6" joists, and the surface cleaned off, and treated with grout before next course of concrete is laid.

CONTRACTORS RESERVATION:

The contractor will be allotted space as shown by the plan at the southeastern end of the Main Island for the storage

of materials, mixing plant and casting operations. He will be required to erect a substantial board fence along line of the hedge to protect it during his operations, and protect the flag pole, etc. Should the fog bell interfere with the operation of handling blocks it shall be removed with its tower by the contractor to new location in the vicinity, where directed by the Chief Enginerr.

USE OF BASIN:

The contractor must so conduct the work that the present ferry service and the navigation in the ferry basin shall not be discondinued.

Probably not more than 1/3 of the length of the site of the work can be withdrawn from the present use at any time.

PROTECTION OF WORK:

Portions of completed wall must be protected from injury resulting from the navigation and embarkation in the ferry basin, and any injury so received must be repaired and the wall left in perfect condition at the completion of the contract.

INSPECTION:

Contractor shall furnish the engineer facilities for inspecting the foundation work when requested, and diving and other apparatus so used will be paid for at the regular market rate, by the Department of Commerce and Labor as an extra to contract.

CHARACTER OF BOTTOM:

The profile of borings given on the plan shows the general character of ground likely to be encountered in excavating the foundation trench. These borings were made by the hydraulic jet of 3/4" pipe with 1/2" nozzle, operating at 200 lbs. pressure. The line of borings was taken close along the face of the cribwork, and the borings were made at 10 foot intervals. The penetration was generally stopped by apparent ledge rock or large boulders presenting a top surface of at least 75 square feet, this being determined by trial borings (not plotted) in the immediate vicinity of the points given on profile.

PART OF SITE PREVIOUSLY DREDGED:

The attention of bidders is directed to the fact that dredging has already been performed under another contract over a portion of the area coming within the foundation lines of the wall contemplated by this specification.

The two prisms dredged are each sixty feet in length and twelve feet in width at the bottom, extending between points from 525 to 585 and from 645 to 705 on the profile of borings. They are clearly indicated on the plan.

The prisms described were dredged for the purpose of determining whether or not the present cribwork, some of which was installed in 1842, and of which no plans are extant, would settle forward into the trench for foundation of the new wall when excavation was performed. Dredging was carried down to rock at the depth required by these specifications. The trench dredged does not leave any embankment in front of the present cribwork as called for by those specifications, and since it measures only twelve (12') in width at the bottom, from the face

of present cribwork additional dredging must be done on the southwesterly embankment to accommodate footings for new wall. Redredging of silt, or other material now overlying the dredged areas must also be performed under this contract.

It will be observed that no material distortion of existing cribwork has taken place through the dredging of trial areas described, immediately in front of said cribwork.

DREDGING:

The contractor will be required to obtain a comparatively level bottom over the entire trench, which shall be at least fifteen (15') in width and correspond with grade-minus 30. To accomplish this, such quantity of material must be dredged as may be necessary. No guarantee is given that the embankments on either side of trench will stand the slope shown by plan, that slope being merely illustrative in a general sense.

Dredging embraces the removal of all materials, except solid rock to the depth required, and includes large and small boulders, loose stones, mud, clay, sand, shells and old logs and piles driven or not driven.

Should it be decided to remove any solid rock, or should dredging be ordered at over-depth, it will be paid for according to unit prices bid by contractor on proposal sheet.

DISPOSITION OF MATERIALS:

All dredged materials must be disposed of according to the laws of the United States, or of the statutes of the states of New York or New Jersey, or the ordinances of the City of New York governing the disposition of this material, and any illegal disposition of material will deprive the contractor of any payment for removal of same, and subject him to the legal penalty made and provided for the violation of said laws and ordinances.

MEASUREMENT OF MATERIALS REMOVED:

All dredged material at over depth will be measured in scows or other vessels used for conveying it away, and any material not so measured before removal will not be paid for.

In payment for removal of solid or ledge rock, place measurements will govern.

The contractor shall allow ample time to the Chief Engineer in charge, or his representative, to measure the scows or other vessels used in conveying away the dredged material before the loading of the scows, or other vessels, is commenced, and the contractor shall give the Chief Engineer reasonable and sufficient notice prior to the departure of each scow or other vessel containing material dredged under this contract to enable him to examine and measure the dredged material contained therein before it is removed from the vicinity of the work.

Any dredged material reported by Municipal, State or Nation authorities as not disposed of in accordance with the law will not be paid for unless satisfactory evidence is submitted to the contrary.

SCOWS:

Contractor must file at Civil Engineer's office sketch plan or blue-print of each scow or other carrying vessel he proposes to use in this work before the commencement of operat-

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ions. These sketches shall show clearly the dimensions and capacity of each pocket in each scow, and the capacity of each pocket when filled with one foot shortage. The above sketches must be accompanied by a sworn statement from the proper officer of the company prosecuting the work that the capacities shown on sketches are correct and authentic.

FOUNDATION:

Before any work is done on the foundation the trench shall be cleared of any material which may have collected subsequent to dredging.

The foundation shall be composed of closed bags of concrete carefully laid by divers to break joints, and to form a solid mass. Generally the volume contained in each bag shall be determined by the quantity which can be conveniently and efficiently handled. The bags may be of jute or cotton.

Concrete for bag work shall be a dry mixture (unless otherwise ordered) of one part Portland cement, two parts sand, and three parts by volume of broken stone or gravel, thoroughly incorporated and bagged immediately before depositing under water.

EXTRA BAG WORK:

Should the progress of the work develope the necessity for additional dredging beyond that specified, and should the additional excavation entail the use of greater thickness of mat foundation, the extra bag work required will be paid for at the unit rate stated by contractor on proposal sheet.

ANCHOR BLOCKS:

Concrete blocks containing a 6" x 6" timber which has been immersed in water six (6) days, shall be set flush with the top of the bag work as shown on the plan, and spaced ten (10') feet apart, except where prevented by the presence of rock; in which case other means shall be used to fasten the angle irons securely and accurately to line and grade.

These blocks shall be of 1-3-5 concrete which has hardened for a period of at least thirty (30) days above water, and shall conform to the dimensions shown on the plan.

TRAMS:

To the wooden centers of these concrete blocks 6" x 19.6 lb. angle irons shall be spiked on line and shimmed to grade as shown on the plan.

These angle irons shall be in as long lengths as possible, joints to have 1/2" fish plates bolted on.

LEVELLING COURSE:

The space between these angle irons or trams shall be filled with heavy grout composed of equal parts of Portland cement, and sand mixed with coarse grit or screenings. This mixture shall be of such consistency as to flow easily, It shall be deposited on the concrete bag work through a tube, or by means of a "tremie" and shall be levelled immediately with a steel faced straight edge extending across the trams, and handled by two divers, or by mechanical means under the supervision of one diver. The finished levelling course shall present a true and

level plane. No depression or projections will be permitted.

No further work will be permitted upon the finished foundation until the levelling course has seasoned for thirty (30) days.

BELOW WATER BLOCKS:

On the foundation prepared as above, concrete blocks shall be set to line with 1" joints.

These blocks shall be cast above water and seasoned for a period of not less than thirty (30) days before being handled, or moved to incorporate in the work. They shall be of dimensions shown on the plan. Chain grooves shall be cast therein as may be required, there being at least one groove in each end of each block, semicircular in cross section, radius 6", to act as key between blocks when filled with concrete bags. Should more than one chain groove be used in each end, the additional groove must likewise be filled with concrete bag work.

Concrete for these blocks shall be in the proportion by volume of one part cement, two and one-half parts sand and five parts stone.

The contractor shall begin the casting of these blocks immediately after the award of contract, and before the dredging is started. Each block shall be cast in one complete operation, and marked with date of casting in a conspicuous place as soon as forms are removed.

Stone shall be spaded away from the face of forms, and concrete shall be thoroughly tamped.

Surface of concrete blocks shall be uniform and even without voids.

As soon as the mass of concrete has set sufficiently to retain its true from without damage, the forms shall be removed and the surface shall be rubbed smooth. A dense impervious front face is required on said blocks.

Concrete in the blocks must be protected against undue drying influences of sun or wind. If so directed by the Chief Engineer, the blocks shall be sprayed by contractor with fresh water.

Whenever necessary the Chief Engineer may withhold permission to mix concrete in freezing weather, or until the ingredients entering into the composition of the concrete shall be so heated that when the concrete is mixed and ready to be deposited it shall have a temperature of not less than 75 degrees Fahrenheit. Newly formed concrete must be protected against the action of rain or frost, to the satisfaction of the Chief Engineer.

FORMS FOR BLOCKS:

A sufficient number of forms for casting these blocks must be provided as directed by Chief Engineer. The forms shall be of steel, suitably braced on the outside to insure the accurate finished dimensions shown on plan.

Before casting these blocks the contractor shall submit for approval the plans of forms showing the arrangement

for chain grooves, key, bracing, etc., which may be necessary to obtain a satisfactory block.

Provision shall be made for casting whatever odd length block may be necessary to complete the length of wall required.

Provision must also be made to cast holes in blocks where sewerage or drain pipes empty into dock basin through the present cribwork.

UPPER WALL:

The upper wall shall be built of granite facing, with a concrete backing poured in place, as heretofore described under "Sequence of Work". Concrete for the upper wall shall be of same proportions as that in the under water blocks.

Forms for the upper wall construction shall be of tongue and groove stock of suitable dimensions and suitably braced to insure the finished dimensions shown on plan.

At each gangway provision shall be made for casting two 12" holes 8 feet deep, spaced 8 feet o.c. and 4 feet from the ends of the wall, these holes being for the housing of wharf drop plungers to be installed under another contract.

GRANITE:

Stone is to be a uniformly colored granite, and except where otherwise specified, is to be square dressed with a rock face.

Where called for as cap stone and wall ends at gangway.

stone is to be bush-hammered, and dressed for horizontal joints.

Stone shall be laid in courses with alternate headers and stretchers, and with a 3/4" tooled joint, except cap stones, which shall be set with a 1/2" tooled joint.

SIZES:

Headers shall be 24" long on the face, stretchers 4 feet long, thickness of stone shall be 12" for stretchers, 18" for headers. A variation of 10% will be permitted either way in the length and thickness of headers and stretchers.

Height of courses shall be as shown on plan.

The cap stone shall be bush-hammered and finished in lengths to lay 6 feet. Stone shall be drilled for bolts for the mooring bollards, backing log, and 12" holes at inclines described.

All stone shall be set to line and grade as given by the Chief Engineer.

Mortar for joints shall be one part cement, three parts sand.

CEMENT, SAND AND AGGREGATE:

Cement shall conform in all respects to the requirements of U. S. Government specification, as promulgated in Executive Order, April 30, 1912, (copy attached hereto). Brand of cement used shall be specifically approved by Chief Engineer.

Stone for concrete shall be of an approved kind

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and quality of rock and shall be free, before being crushed, from soil, mud or dust, and it must be clean when used in the work. Soft stone shall not be used in making concrete. Crushed stone shall be in fragments that will pass through a two and one-half inch circular hole, and that will not pass through a one-eighth inch hole.

All sand shall be composed of grains varying in size from fine to coarse, not over one-eighth of an inch in size, it shall be clean, sharp, and shall be screened and washed if required.

Gravel shall be composed of hard, durable clean stone of an approved kind and quality. It shall be in fragments that will pass through a two and one-half inch circular hole, and that will not pass through a one-eighth inch circular hole. Gravel mixed with mud, clay, dirt or quicksand shall be washed before delivery on site of work.

Samples representing the materials to be used in concrete shall be submitted and approved by the Chief Engineer before use in the work.

BACKING LOG:

A backing log shall be furnished the entire length of the wall, except at inclines.

Timber shall be 10" x 12" dressed long leaf yellow pine set flat side down, in lengths of not less than 30 feet.

The timber shall be spliced over blocks hereafter described, by a scarf joint with a 24" lap and two 1" bolts.

The two upper corners shall be cut to a 1" bevel as shown on the plan.

12 x 12 H.P. blocks bevelled from 2" thickness to give a horizontal upper surface shall be placed under the backing log at intervals of 10' c.c.

1" bolts shall be set in the cap stone 10" from the face and 10' c.c. to hold the blocks and backing log. Holes in the cap stone shall be 2" or more in diameter and bolts shall be set in lead to project 9" above the face of the stone.

Backing log shall be recessed for 3" washers and nuts and the hole shall be tightly plugged with a plug 2" deep and planed flush with the surface.

PAINT:

The backing log and blocks for mooring bollards hereafter described shall be given two coats of white lead and oil; the last coat to be applied at the completion of the work.

MOORING BOLLARDS:

The cast iron double bit mooring bollards now set on the crib work shall be reset by the contractor, at about 50 feet intervals, as directed by the Chief Engineer.

Bollards shall be mounted on a planed H.P. block 10" x 14" x 72", with set broad face down, ends rounded to a 10" radius.

Six 1" bolts for each bollard shall be set as shown on plan, in 3" pipes 12" long, capped by plates and so set in the concrete that the heads shall remain loose in the holes through the plate.

Bolts shall be flush with the nuts when the bollards are bolted down.

CLEANING UP:

Before the completion of the work the contractor shall, under the direction of the Chief Engineer, remove all debris and restore the grounds to a neat condition.

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SPECIFICATION

FOR ALL LABOR AND MATERIALS REQUIRED TO CONSTRUCT SECTION OF SEA WALL AT THE U. S. IMMIGRANT STATION, ELLIS ISLAND, N. Y. H. UNDER "SEA WALL CONTRACT NUMBER TWO".

GENERALLY:

19. All apparatus, materials, labor, etc., shall be subject in every respect to the approval of the Chief Engineer.

20. Contractor will be held responsible for all damage resulting from any improper conduct of this work, and must make the same good at his own expense.

21. He will be held responsible for all damages arising from his operations to completed or incompleted sections of the wall until final completion and acceptance of the entire work.

ENGINEER:

22. The contractor must employ a Resident Engineer to lay out the lines of the proposed sea wall and to establish the elevations shown on drawing, and called for by these specifications. The contractor will be held responsible for the accurate placing, leveling and alignment of his work, and the entire construction must proceed under the supervision of said Resident Engineer.

BENCH MARK:

23. The bench mark from which levels shall be taken is a small brass plate located on ~~copy~~ coping of sea wall of Main Island, near ferry house, and shown thus (X.B.M.) on the plan.

BASIS OF PAYMENT:

24. Payments will be at the unit rate per lineal foot of finished wall bid by contractor on proposal sheet, for three sorts of wall shown and required, namely, "deep wall on bag work", "deep wall on piles", and "shallow wall on piles", including backing log, bollards, etc., for that portion of finished wall installed.

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INTENT OF SPECIFICATION:

24. It is the intent of this specification and drawing to describe and require the construction of a section of sea wall along North East face of No.2 Island, in ferry basin, about 760 feet long, exclusive of dredging. Cleaning bottom after dredging is performed by other contractor, driving piles and forming foundation for wall is included in this contract.

25. This contract will embrace the construction of as many linear feet of said proposed sea wall as the present appropriation approximating $100,000 will permit, there being some reservation of funds for certain steel sheet piling should same be required during dredging operations, or in the progress of this work.

DESCRIPTION:

26. For the under water construction the wall shall be composed of concrete blocks cast and seasoned in the air, together with a mat foundation of concrete bag work or piles and mass concrete, and for the above water construction, or the upper eleven feet of the wall, a granite facing backed with concrete poured in its permanent location.

ALTERNATE PROPOSALS:

27. Bidders will be permitted to submit alternate propos-

als at a unit rate per lineal foot of finished wall based upon their own plans for constructing this section of wall. These plans may embody a modification of the type of wall shown and described herein, a modification of the method of construction for this type, or an entirely different scheme for accomplishing the desired end, namely: A retaining sea wall possessing the same factor of safety as that required by these specifications and drawing, with granite facing for the upper eleven feet thereof, in front of which dredging may be done to a depth of eighteen feet below mean low water without effecting in any manner the integrity of the construction. Such alternate proposal to entitle them to consideration must fully set forth by plans, specifications, and description, the exact method to be followed in this specific instance.

28. Bidders must understand that the Department of Labor is in no way bound to accept any alternate method of construction, but will consider each proposals if properly and intelligently presented; and recommendations for award will be based solely upon the merit and economy of such alternate proposals in comparison with the construction shown and described herein.

PLANT REQUIRED:

29. The contractor for this work will be required to use floating equipment which is fully capable of handling and setting the under-water concrete blocks shown on attached drawing, and satisfactory to Chief Engineer. All diving apparatus must be modern and subject to approval of Chief Engineer. Concrete mixing plant

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must be of a power driven type specifically approved by the Chief Engineer. Gravity mixers, or continuous mixers will not be permitted. Contractor's shed for storage of cement, etc., must be ample in size, of neat appearance, rain proof and well constructe
Arrangements for storage and handling of materials, as well as th
cast blocks will be subject to Chief Engineer's approval.

30. It is required that the concrete blocks specified be taken from easterly face of the island and placed in position by means of a suitable floating derrick and its tackle and gear, sin
an attempt to place said blocks from a railway laid along basin face, or from a derrick working on top of present crib dock, woul
probably result in the destruction or sliding movement of the old crib beneath.

TEMPORARY PRIVY:

31. The contractor must provide a suitable temporary privy, for the use of his workmen, to be placed where directed, maintai
in a sanitary condition, and at completion of the contract remov
and the premises left clean.

WATER:

32. Water from Ellis Island water main will be furnished c
tractor without charge when the main is in use; but if said wate
main is broken, or if for any cause an adequate supply for both
U. S. Immigrant Station and the contractor, cannot be obtained f
this main, the contractor must furnish all fresh water required
his plant and work at his own expense. The contractor shall con
nect to water supply system of the Island where directed by Chie

Engineer. The use of salt water or foul water in making concrete will not be allowed.

CHARACTER OF BOTTOM:

33. The profile of borings given on the plan shows the general character of ground likely to be encountered in excavating, under another contract, the foundation trench. These borings were made by a hydraulic jet of 3/4" pipe with 1/2" nozzle, operating at 200 lbs. pressure. The line of borings was taken close along the face of the cribwork and the borings were made at 10 feet intervals. The pentration was generally stopped by apparent ledge rock or large boulders presenting a top surface of at least 50 square feet, this being determined by trial borings (not plotted) in the immediate vicinity of the points given on the profile.

CONTRACTORS RESERVATION:

34. The contractor will be allotted space as shown by the plan, at the Southeastern end of No.2 Island for the storage of materials, mixing plant and casting operations.

USE OF BASIN:

35. The contractor must so conduct the work that the present ferry service and the navigation in the ferry basin shall not be discontinued.

36. Probably not more than 1/3 of the length of the site of the work can be withdrawn from the present use at any time.

PROTECTION OF WORK:

37. Portions of completed wall must be protected from injury

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resulting from the navigation and embarkation in the ferry basin, and any injury so received must be repaired by contractor and the wall left in perfect condition at the completion of the contract.

INSPECTION:

38. Contractor shall furnish the engineer facilities for inspecting the foundation work when requested, and diving and other apparatus so used will be paid for at the regular market rate, by the Department of Labor, as an extra to contract.

SEQUENCE OF WORK:

39. Beginning at a point numbered 760 on the profile of borings, contractor shall start cleaning the bottom with centrifugal pump suction hose after dredging operations are completed, and proceed in a northwesterly direction along the face of the present cribwork, on No.2 Island side of the ferry basin, to obtain a trench with a bottom width of not less than fifteen (15) feet. Depth of trench when cleaning is completed must at least equal depth to which dredging is done. This depth will be in general not less than minus 28.5, nor more than minus 30 feet, as shown on the accompanying plan. Should, however, the bottom prove unstable for foundation work at the maximum depth above stated, the dredging, which is to be performed under another contract, may be carried to a greater depth, until suitable foundation strata is uncovered.

40. Having cleaned out a suitable trench and there being obtained a satisfactory bottom for approximately 100 feet from the

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point of beginning, the contractor shall proceed to lay the mat foundation for the wall by depositing concrete under water in jute or cotton bags. He shall then proceed to set guide rails shown on plan, by precision instrument measurements, to the required line and grade, properly shimming, fish-plating and anchoring them in rigid position. Fill all openings beneath rails with small bags of concrete composition as specified for "Bag Work", and then by depositing concrete composed of one part cement to one part sand and coarse grit or stone screenings mixed through a "tremie" (or tube) proceed to fill between these guide rails, and screed the surface to a true level plane. Surface of mass concrete to be fully equal to similar work on cement sidewalks when screed for troweling. The details of work required under this paragraph are more fully set forth by paragraphs 53, 54 and 55.

41. Having formed a section of this finished and levelled foundation above described, after satisfactory inspection, and seasoning or hardening period of 48 hours, or such other period as may be prescribed by the Chief Engineer, the contractor shall proceed to scour the surface of the foundation work by a hydraulic jet and immediately thereafter shall begin to set the under water blocks.

42. Having set at least four of the under-water blocks, properly jointed by concrete bags rammed into the chain grooves to form a key, as more fully described by paragraph 68, the construction of the upper eleven (11) feet of the wall is to be started as

shown on the plan, and substantially in accordance with the following method, unless otherwise directed by the Chief Engineer.

43. The lowest course of rock faced stone shall be placed on top of the cast concrete blocks, and forms as specified for casting the upper concrete portion of the wall shall be placed and secured in an approved manner. The joints between granite and concrete block and forms and concrete blocks shall be made water tight with oakum.

44. The first stone course shall be laid at lowest practicable state of tide or the forms shall be watertight and kept dry while depositing concrete.

45. Cramp irons or ties securing the rock face stones to concrete shall be placed as shown on the plan as the courses are laid, a clearance for the iron ties to rest in being cut in the top of each stone.

46. Contractor shall proceed to fill the upper part of the forms with concrete and lay and bed the facing stones with cement mortar joints, repeating this process course by course, until the capstone of the sea wall is placed. New concrete joints, occurring when construction is stopped from day to day, must be provided with keyways formed by 4" x 6" joints, and the surface cleaned off, and treated with grout before next course of concrete is laid.

The joists must be removed before concrete pouring is resumed.

FOUNDATION:

47. Where the character of bottom disclosed by dredging indicates that clay and boulders are compacted so as to form hard pan, and thus can properly support a wall of the weight and design herein specified, the construction of wall shall follow that indicated on drawing by legend "Typical Section of Deep Wall on Bag Work".

48. Where hard pan is not disclosed or where it is evident that the bearing character of the soil is insufficient to carry a wall of character named, said wall shall set on piles as required by paragraph 56.

49. It may be expected that about 400 feet of the entire stretch of wall it is proposed to now construct may be carried on a pile foundation, and such portion of the remainder as the appropriation will permit to be constructed, will be carried on rock and hard pan.

50. In addition to the foregoing, it is proposed, if the appropriation proves sufficient, to construct not less than 100 feet nor more than 150 feet of wall at the extreme westerly end of the slip of the character shown on plan and described as "Typical Section of Shallow Wall on Piles."

51. Before any work is done on the foundation the trench shall be cleared of any material which may have collected subsequent to the dredging, to be performed under another contract.

52. Where suitable bottom is obtained by dredging the foundation shall be composed of closed bags of concrete carefully laid

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by divers to break joints, and to form a solid mass. Generally the volume contained in each bag shall be determined by quantity which can be conveniently and efficiently handled. The bags may be of jute or cotton.

53. Concrete for bag work shall be a dry mixture (unless otherwise ordered) of one part Portland cement, two parts sand, and three parts by volume of finely broken stone or small gravel, thoroughly incorporated and bagged immediately before depositing under water.

54. When bag concrete work has been built up to requisite height the guide rails heretofore referred to shall be placed in position. These rails shall be steel railroad rails weighing sixty lbs. per yard, laid on side, and anchored as directed.

55. The space between guide rails shall be filled with heavy grout composed of equal parts of Portland cement, and sand mixed with coarse grit or stone screenings. This mixture shall be of consistency as to flow easily. It shall be deposited on the concrete bag work by means of a "tremie", and shall be levelled immediately with a steel faced straight edge extending across the trams, and handled by two divers, or by mechanical means under the supervision of one diver. No depression or projections will be permitted.

56. Where bottom uncovered by dredging proves unsuitable for supporting the wall on foundation above specified, the wall constructed shall be carried on piles, as shown by detail on plan

entitled "Typical section of deep wall on piles and mass concrete".

57. Piles shall be of yellow pine ("Lob Lolly" pine will not be accepted), about 50 feet in length, not less than 7" at point, and shall measure at least 12" in diameter at the point of cut off. They shall be driven to refusal after dredging is completed and bottom cleaned; spaced 2' 8" between centers transversely of the wall, in bents 3' 4" center to center longitudinally of the wall, thus giving each under-water block a bearing on twelve piles.

58. Piles shall be cut off under water to the precise grade required, by circular saw or other means approved by the Chief Engineer.

59. The cut off shall be absolutely square and level, and otherwise satisfactory to Chief Engineer.

60. Piles cut off below grade, or with an angular cut off, will be required to be drawn and replaced by new ones.

61. After piles are cut off, a screen of approved type shall be set by a diver, in order to determine the exact position of the piles. This screen shall be of size and mesh approved by the Chief Engineer. Screen shall be placed on top of piles, where same are cut off, and the position of each pile shall be marked on screen by the use of three harness clips, which shall be so set by diver as to show location of each pile head within screen limits The screen shall be then hoisted, and the position of the piles shall then be located from the screen. If in the opinion of the Chief Engineer the foundation piles are not in proper position

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under each block, additional piles shall be driven by the contractor, without additional charge, in approved and directed positions, and said additional piles cut off at grade required.

POSSIBLE ADDITIONAL FOUNDATION PILES:

62. If conditions developed during progress of dredging to be performed under another contract, or encountered in driving foundation piles, require, contractor shall drive an additional row of said piles in rear of those specified for base foundation and in position indicated by plan, and bidders will state on their proposal sheet a unit price per pile, for said driving and cutting off at grade shown. Said additional piles, if ordered, shall in all respects conform to requirements for other foundation piles.

63. When piles are accepted by Chief Engineer, the bottom around them shall be again cleaned with suction pump, and the space around them filled up to grade minus 27.8 with mass concrete deposited by tremie and carefully levelled. This mass concrete shall be in proportions of 1-2-3. Concrete mass shall be kept down from one to two inches below top of piles to give mattress proper hold.

64. After seasoning period prescribed has elapsed, contractor shall clean the surface of concrete and pile heads with hydraulic jet, and proceed to set blocks on this foundation, using a mattress of concrete in burlap. This mattress shall be prepared in a wooden frame, woven across with tarred marlin with one layer of burlap sewed on. Over this first layer of burlap spread dry cement and

sand in equal parts to a uniform thickness of one inch, and cover with another layer of burlap, stitched to the first at edges and to the marlin where directed. Lower the entire mattress to the top of pile heads and remove the frame by cutting the marlin. Then proceed to set the under water blocks before mattress mortar is set.

SHALLOW WALL:

65. A section of shallow wall will be constructed in the vicinity of ferry rack, where deep water is not required in front of sea wall. This shallow wall will be carried on piles and framing, substantially as shown by plan. Piles shall be driven and cut off as above specified for deep wall on piles. The dredging (performed under another contract) over this part of the work will be carried to grade minus 15.

66. After piles are driven and framed with platform wide enough to start wall work, fill in with rip rap the space between the pile platform and crib work, up to level of underside of platform, and then complete the platform, after which wall operations may be started.

BELOW WATER BLOCKS:

67. On the foundations prepared as above, concrete blocks shall be set to line, with 1" joints.

68. These blocks shall be cast above water, and seasoned for a period of not less than thirty days before being handled, or moved to incorporate in the work. They shall be of the dimensions

shown on plan. Chain grooves shall be cast in these blocks, there being required two chain grooves at each end of each block, semi-circular in cross-section, radius 6", as shown on drawing. In order to form a substantial key between blocks the chain grooves named shall be filled with 1-2-4 concrete in gunny or cotton sacks of approved size, each sack containing concrete to be thoroughly rammed when placed.

69. Concrete for these blocks shall be in the proportion by volume of one part cement, two parts sand and four parts stone.

70. Contractor shall begin the casting of these blocks immediately after the award of contract, and before the dredging is started. Each block shall be cast in one complete operation, and marked with date of casting in a conspicuous place as soon as forms are removed.

71. Stone shall be spaded away from the face of forms, and concrete shall be thoroughly tamped.

72. Surface of concrete blocks shall be uniform and even and show no voids.

73. As soon as the mass of concrete has set sufficiently to retain its true form without damage, the forms shall be removed and the surface shall be rubbed smooth. A dense impervious front face is required in said blocks.

74. Concrete in the blocks must be protected against undue drying influences of sun or wind. If so directed by the Chief Engineer, the blocks shall be sprayed by contractor with fresh water.

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PLATFORM:

75. The platform on which blocks are cast must be absolutely stable and level, since settlement from the weight of wet concrete in forms will cause distortion of the finished blocks. Contractor will be required to drive sufficient number of piles on reservation allotted to him, to sustain the weight of the number of blocks which he elects to cast in a group for seasoning prior to incorporation into the construction work.

76. It should be borne in mind that the minimum seasoning period specified for these blocks is 30 days. See paragraph 68.

77. This platform shall be framed and decked in substantial manner, according to plan approved by Chief Engineer. A bearing value of ten tons will be allowed for each pile under platform.

CASTING CONCRETE:

78. Whenever necessary the Chief Engineer may withhold permission to mix concrete in freezing weather, or until the ingredients entering into the composition of the concrete shall be so heated that when the concrete is mixed and ready for depositing it shall have a temperature of not less than 75 degrees Fahrenheit. Newly formed concrete must be protected against the action of rain or frost, to the satisfaction of the Chief Engineer.

FORM FOR BLOCKS:

79. A sufficient number of forms for casting these blocks, not less than two, must be provided. The forms shall be of steel, suitably braced on the outside to insure the concrete finished dimensions shown on plan.

80. Before casting these blocks the contractor shall submit for approval the plans of forms showing the arrangement for chain grooves, key, bracing, etc., which may be necessary to obtain satisfactory block.

81. Provision shall be made for casting whatever odd length block may be necessary to complete the length of Sea Wall required.

82. Provision must also be made to cast holes in blocks where sewerage or drain pipes now empty into dock basin through present cribwork and for weep holes 100 feet apart. Said weep holes to be set 6" below mean low water and to consist of 6" glazed drain pipe.

UPPER WALL:

83. The upper wall shall be built of granite facing, with a concrete backing poured in place, as heretofore described under "Sequence of Work". Concrete for the upper wall shall be of same proportions as that in the under water blocks.

84. Forms for the upper wall construction shall be of tongued and grooved stock of suitable dimensions and suitably braced to insure the finished dimensions shown on plan.

GRANITE:

85. The stone is to be a uniformly colored granite specifically approved by Chief Engineer and equal to the approved sample specimen. Except where otherwise specified it is to be square dressed with a rock face.

86. Cap stones are to be bush-hammered and dressed for horizontal joints.

87. Stone shall be laid in course with alternate headers and stretchers, and with a 1/2" tooled joint, except cap stones, which shall be set with a 1/4" tooled joint.

88. Headers shall be 24" long on the face, stretchers six feet long, thickness of stone shall be 12" for stretchers, 18" for headers. A variation of 10% will be permitted either way in the length and thickness of headers and stretchers.

89. The capstone shall be bush-hammered and finished in length to lay eight feet. Stones shall be drilled for bolts for the mooring bollards and backing log.

90. All stone shall be set to line and grades given by the Chief Engineer.

91. Mortar for joins shall be one part cement, three parts sand.

POINTING:

92. After wall has thoroughly set, all face joints shall be pointed with non-staining cement mortar composed of one part cement and two parts sand.

CEMENT, SAND AND AGGREGATE:

93. Cement shall conform in all respects to the requirements of U. S. Government specification as promulgated in Executive Order April 30, 1912, (copy attached hereto), and shall be a brand

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which has been successfully used in like structures for a period of at least three years.

94. Stone for concrete shall be of approved kind and quality of rock and shall be free, before being crushed, from soil, mud or dust, and it must be clean when used in the work. Soft stone shall not be used in making concrete. Crushed stone shall be in fragments that will pass through a two and one-half inch circular hole, and that will not pass through a one-eighth inch hole.

95. All sand shall be composed of grains varying in size from fine to coarse, not over one-eighth of an inch in size, it shall be clean, sharp, and shall be screened and washed if required.

96. Gravel shall be composed of hard, durable clean stone of an approved kind and quality. It shall be in fragments that will pass through a two and one-half inch circular hole, and that will not pass through a one-eighth inch circular hole. Gravel mixed with mud, clay, dirt or quicksand shall be washed before delivery on site of work.

97. Samples representing the materials to be used in concrete shall be submitted and approved by the Chief Engineer before use in the work.

BACKING LOG:

98. A backing log shall be furnished the entire length of the wall, except at gangway in front of hospital.

99. Timber shall be 9-1/2" x 11-1/2" dressed long leaf

yellow pine set flat side down, in lengths of not less than 30 feet.

100. The timber shall be spliced over blocks hereafter described by a scarf joint with a 24" lap and two 1" bolts.

101. The two upper corners shall be cut to a 1" bevel as shown on the plan.

102. 12" x 12" Y.P. blocks bevelled from 2" to 1" thickness to give a horizontal upper surface shall be placed under the backing log at intervals of 10' c.c.

103. 1" anchor bolts shall be set in the cap stone 10" from the face and 10' c.c. to hold the blocks and backing log. Holes in the cap stone shall be 2" or more in diameter and bolts shall be set in lead to project 9" above the top of the stone.

104. Backing log shall be recessed for 3" washers and nuts and the hole shall be tightly plugged with a plug 2" deep and planed flush with the surface.

PAINT:

105. The backing log and blocks for mooring bollards hereafter described shall be given two coats of white lead and oil; the last coat to be applied at the completion of the work.

MOORING BOLLARDS:

106. The cast iron double bitt mooring bollards now set on the crib work shall be reset by the contractor, at about fifty (50) feet intervals, as directed by the Chief Engineer.

107. Bollards shall be mounted on a planed Y.P. block

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10" x 14" x 72" with set broad face down, ends rounded to a 10" radius.

STEEL SHEET PILING:

108. Contractor shall state on his proposal sheet a unit price per ton for approved interlocking steel sheet piling, said piles to be driven to grade required in continuing semicircles having a semi diameter of about 10 feet and on a line in front of hospital buildings, should the necessity for such work arise, after operations, by reason of any shifting of filled in land which surround these buildings. This sheet piling to remain the property of the contractor and be withdrawn at the completion of work, or prior thereto if directed. It is the driving, drawing and use of piling that is to be paid for, not the piling itself. If said sheet piling is required at all, probably not less than 200 tons nor more than 300 tons in lengths of about 30' will be needed.

EXTRA BAG WORK:

109. Should the progress of the dredging work, under another contract, develop the necessity for additional dredging beyond grades heretofore specified, and should said additional excavation entail the use of greater thickness of mat foundation, the extra bag work required will be paid for at the unit rate stated by contractor on proposal sheet.

POSSIBLE ADDITIONAL MASS CONCRETE:

110. If it proves necessary to drive the additional founda-

tion piles, named in paragraph 62, additional mass concrete, at the rate of about one yard per running foot of wall, of the mixture and character described in paragraph 33 of these specifications, shall be deposited by contractor, the proportions of same being one cement, two clean sharp sand. and three broken stone or washed gravel. Bidders will state on their proposal sheet the unit rate at which they will mix and deposit this mass concrete named.

GRAVEL BACK FILL:

111. Should conditions developed during dredging to be performed under another contract seem to make necessary, contractor will be required to dump through a tremmie unwashed gravel, of character obtained from the Glen Cove or suitable beds, along front of sea wall after blocks are set and while substantially completed. Bidders will state a unit price per cubic yard for this gravel, dumped in place along front of wall, assuming that about three yards of same per running foot of wall will be required. Total number of yards of gravel under this requirement will probably not exceed three thousand.

GANGWAY:

112. Install gangway of the same dimensions and finish as the small gangways of No.1 Island wall in front of the center building of general hospital. Holes for hydraulic lift to be omitted.

FORMS FOR CONCRETE:

113. The forms required for casting the concrete of the upper

portion of the wall shall consist of bucks of not less than 4" x 6" joists, straight and true, and spaced not less than 3' 0" on centers. The planking shall be tongued and grooved stuff, close-fitting and not less than 1-1/2" in thickness. All joints shall be made thoroughly tight, and nailing, anchoring and wire securing must be to the satisfaction of the Chief Engineer. Contractor shall be required to furnish for use at one time not less than 40 lineal feet of the form required. The use of nail-sick or unsound material will not be permitted.

Any bracing that would remain bedded in the finished structure unless removed shall be removed when the concrete reaches the appropriate level.

EXCAVATION FOR DEAD MEN:

114. Where anchor bolts are required for shallow walls on piles, contractor shall perform all necessary excavation of crib fill and back fill same in order to install said bolts and their dead men. These dead men shall be of sound yellow pine, round or square timber, be firmly attached to inner side of crib face. Cross section of dead men shall be not less than 120 square feet. Lengths of dead men shall be as required, but in no case less than 5 feet.

PROGRESS PHOTOGRAPHS:

115. Contractor shall furnish two views of the work taken at the end of each month, showing progress thereof. Three carbon prints of each negative to be furnished, mounted on cloth, with flap. Negatives to be 8" x 10".

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SPECIFICATION
FOR ALL LABOR AND MATERIALS REQUIRED FOR SHEET PILING, ETC.,
BEHIND PRESENT CRIB WORK ALONG NORTHEAST FACE OF ISLAND NO. 2,
AT THE U. S. IMMIGRANT STATION, ELLIS ISLAND, N. Y. H.

NOTICE:

The special attention of the contractor is called to the fact that he is invited and advised to thoroughly inform himself in person as to all the existing conditions in regard to the present material, and apparatus which he must connect to, change and remove, under this contract, as no consideration will be given to requests for extras, etc., on the ground that such information was incorrectly or not specifically referred to in the specification.

GENERAL:

It is desired to sheet behind the present cribwork along N. E. side of Island No. 2, part of which cribwork has slid into trench along same now partly dredged.

It is estimated that not less than 250 lineal feet nor more than 650 lineal feet of sheeting will be required.

Sheeting to begin at or near the S. E. end of Island No. 2 and on a line about 25 feet back of the N.E. face, exact location to be indicated by the Chief Engineer.

PAYMENT:

Payment to be at a unit price per square foot board measure.

WATER:

Water from Ellis Island water main will be furnished contractor without charge when the main is in use; but if said water main is broken, or if for any cause an adequate supply for bpth the

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U. S. Immigrant Station and the contractor, cannot be obtained from this main, the contractor must furnish all fresh water required for his plant and work at his own expense. The contractor shall connect to water supply system of the Island where directed by the Chief Engineer.

PILES:

Piles to be of 4" x 8" undressed yellow pine, merchantable quality. From wash borings taken it is believed that piles about 30 feet long will be required, but no definite representation is made on this point. Splined or tongued and grooved sheeting will not be required.

PILE DRIVING:

Driving is to be done with steam hammer (not with drop hammer) and use of jet may be required to secure desired penetratinn. This must be into solid bottom, as required by the Chief Engineer. Piles to be driven in contact vertically and utmost pains must be taken to secure a good alignment which must be satisfactory to the Chief Engineer. Piles to be painted and iron shoes used if so directed by the Chief Engineer.

WHALING PIECE:

Sheathing is to be secured at the top with one yellow pine whaling piece 6" x 10" placed on front face of same and secured by means of two 1/2" round spikes about 10" long, two spikes to each pile. Spiking to be done from the rear to whaling piece in front. All spikes to be bored for.

CONCRETE ANCHORS:

Concrete anchors 6' long 1'0" wide and 4' deep (top flush with ground surface) will be required at intervals of about 20 feet. These anchors to be of concrete of the following proportions: 1 part Portland cement, 3 parts clean, sharp, coarse sand and 5 parts of broken stone or gravel, not over 3" in diameter. Concrete to be well tamped in place. These anchors to be backed with yellow pine washers, each washer being composed of six 6 feet lengths of 3" x 8" yellow pine spiked together and backed with one 4 feet length of 4" x 10" yellow pine placed vertically across same, and will be paid for at the unit price stated in accepted bid, per cubic yard of concrete actually in place. This includes the excavation, and necessary forms and timber washers named. Yellow pine washers to be bored for 1-1/4" anchor rods.

ANCHOR RODS:

Anchor rods shall be 1-1/4" diameter and from 20 feet to 30 feet long, to be heavily galvanized and painted two coats of hot asphalt. Rods to extend from front face of whaling piece to back of yellow pine washers at concrete anchors through holes bored for same. Ends of rods to be fitted with cast iron washers, not less than 4" diameter, and square nuts. Anchor rods to be set into position in yellow pine washers and concrete anchors cast about same.

MOVING BELL:

Fog bell, together with its frame, shall be raised from its present position and moved back on Island No. 2 to such point as the Chief Engineer will designate. For this item bidder will state separate price on proposal sheet.

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STEEL SHEET PILING:

Bidders shall state on proposal sheet an alternate unit price per square foot for approved interlocking steel sheet piling weighing not less than 35 pounds per square foot, said piles to be driven to grade required (about 30') in continuing semicircles having a semi-diameter of about 10 feet on a line behind present cribwork as already described for yellow pine sheathing, should it be decided to use steel sheeting in lieu of wood piling. This sheet piling to remain the property of the contractor and be withdrawn after completion of proposed sea wall work, or prior thereto, if so directed. Bidder may assume use of steel sheet piling will be required for about 12 months after driving same is completed. Payment for said piling will be made after satisfactory driving thereof is finished. The removal of said piling in a proper manner must be guaranteed by contractor's bond. It is the driving, drawing and use of piling that is to be paid for, not the piling itself.

Should steel sheeting be decided upon, no anchor rods or concrete anchors, etc., will be required.

SPECIFICATION

FOR ALL LABOR AND MATERIALS REQUIRED TO CONSTRUCT
SECTION OF SEA WALL AT THE U. S. IMMIGRANT STATION,
ELLIS ISLAND, N. Y. H. UNDER SEA WALL CONTRACT
NUMBER THREE.

GENERALLY:

(19) Bidders must visit the site, inform themselves of all governing conditions, and include in their estimate all items of labor and materials and plant required or necessarily implied, that may be necessary for the entire completion of the work in accordance with this specification, whether specifically mentioned or not.

(20) This specification is intended to supplement the drawing, and, therefore, it will not be the province of this specification to mention any portion of the construction which the drawing is competent to explain, and such omission is not to relieve the contractor from carrying out such portions only indicated on the drawing, and should items be required by the specification not indicated on the drawing they are to be supplied, even if of such nature that they could have been indicated thereon. Any item which may not be indicated on the drawing or mentioned in the specification, but are necessary to complete the entire work, must be supplied in place.

ENGINEER:

(21) The contractor must employ a competent Civil Engineer and Surveyor to lay out the lines of the proposed sea wall and

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to establish the elevations shown on drawing and called for by this specification. The contractor will be held responsible for the ~~accure~~ accurate placing, leveling and alignment of his work and the entire construction must proceed under the supervision of said Civil Engineer.

BENCH MARK:

(22) The bench mark from which levels shall be taken is a small brass plate located on coping of Sea Wall at entrance of Ferry Basin.

BASIS OF PAYMENT:

(23) Payment will be at the unit rate per lineal foot of finished wall bid by contractor on proposal sheet, for three sorts of wall shown and required, namely, "DEEP WALL ON BAG WORK", Section A, "DEEP WALL ON PILES", Section D, and "WALL ON CRIBWORK" Section B, including "Backing Log, Bollards, Gangway incline, etc. for the portion of finished wall installed.

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INTENT OF SPECIFICATION:

(24) It is the intent of this specification and drawing to describe and require the construction of a section of sea wall on crib work at South East end of No. 2 Island, about 209 feet; across basin between No. 2 and No. 3 Islands, about 225 feet, and on crib work along Southeast and Southwest bulkhead lines of No. 3 Island, about 1050 feet, including excavating, dredging, pile driving and sheet piling.

(25) The appropriation for this contract (SEA WALL CONTRACT NUMBER THREE) is $200,000.00.

DESCRIPTION:

(26) For the under water construction the wall shall be composed of concrete blocks cast and seasoned in the air, together with a mat foundation of concrete bag work, between points E & F concrete supported on piles at D and between E & G and F & H, and for the upper eleven feet of the entire wall a granite facing backed with concrete poured in its permanent location as shown by Sections A, B & C as may be required.

PLANT REQUIRED:

(27) The contractor for this work will be required to use floating equipment which is fully capable of handling and setting the under water concrete blocks shown on attached drawing, and satisfactory to Chief Engineer. All diving apparatus must be modern and subject to approval by Chief Engineer.

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(28) Concrete mixing plant must be of power driven type specifically approved by the Chief Engineer. Gravity Mixers or continuous mixers, will not be permitted. Shed for storage of cement, etc. must be of ample size, of neat appearance, rain proof, and well constructed.

(29) Arrangements for storage and handling of materials as well as the cast blocks will be subject to the approval of Chief Engineer.

(30) It is required that the concrete blocks specified, be taken from south east end of No. 2 Island, and placed in position by means of a suitable floating derrick and its tackle and gear.

TEMPORARY PRIVY:

(31) The contractor must provide a suitable temporary privy, for the use of his workmen, to be placed where directed, maintained in a sanitary condition, and at completion of the contract removed and the premises left clean.

WATER:

(32) Water from the Ellis Island Water Main will be furnished contractor without charge when the main is in use; but if the water main is broken, or if for any cause an adequate supply for both the U. S. Immigrant Station and the Contractor, cannot be obtained from the main, the contractor must furnish all fresh water required for his plant, and work at his own expense. The contractor shall connect to water supply system of the Island where directed by Chief Engineer.

(33) The use of salt water or foul water in making concrete will not be allowed.

CHARACTER OF BOTTOM:

(34) No borings across the basin of the two islands have been made and the contractor is required to make his own borings to ascertain the prevailing conditions.

CONTRACTORS RESERVATION:

(35) The contractor will be alotted the same space at the South East end of No. 2 Island~~s~~ that was used by contractor for previous SEA WALL construction for the storage of materials, mixing plant and casting operations.

USE OF BASIN:

(36) The contractor must so conduct the work that the present ferry service and the navigation in the ferry basin may in no way be interfered with.

INSPECTION:

(37) Contractor shall furnish the Chief Engineer facilities for inspecting the foundation work when requested, and diving and other apparatus so used will be paid for at the regular market rate, by the Department of Labor, as an extra.

SEQUENCE OF WORK:

(38) Beginning at the South corner of No. 2 Island the contractor shall start dredging operations and proceed across the basin between the two islands to obtain a trench with a bottom width of not less than fifteen (15') feet at a depth of minus thirty (30') feet as shown on the accompanying plan, dredging as close to existing cribs as may be possible without affecting their stability. To accomplish this, such quantity of material must be dredged as may be necessary. No guarantee is given that the embankments on either side of trench will stand the slope shown by plan, that slope being merely illustrative in a general sense.

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Dredging embraces the removal of all materials, except solid rock to the depth required, and includes large and small boulders, loose stones, mud, clay, sand, shells and old logs and piles driven or not driven.

Should it be decided to remove any solid rock, or should dredging be ordered at over-depth, it will be paid for according to unit prices bid by contractor on proposal sheet.

All dredged materials must be disposed of according to the laws of the United States, or of the statutes of the States of New York or New Jersey, or the ordinances of the City of New York governing the disposition of this material, and any illegal disposition of material will deprive the contractor of any payment for the removal of same, and subject him to the legal penalty made and provided for the violation of said laws and ordinances.

All dredged material at over depth will be measured in scows or other vessels used for conveying it away, and any material not so measured before removal will not be paid for.

In payment for removal of solid or ledge rock, place measurements will govern.

The contractor shall allow ample time to the Chief Engineer in charge, or his representative, to measure the scows or other vessels used in conveying away the dredged material before the loading of the scows, or other vessels, is commenced, and the contractor shall give the Chief Engineer reasonable and sufficient notice prior to the departure of each scow or other vessel containing material dredged under this contract to enable him to examine and measure the dredged material contained therein before it is removed from the vicinity of the work.

Any dredged material reported by Municipal, State or National authorities as not disposed of in accordance with the law will not be paid for unless satisfactory evidence is submitted to the contrary.

Contractor must file at Civil Engineer's office sketch plan or blue print of each scow or other carrying vessel he proposes to use in this work before the commencement of operations. These sketches shall show clearly the dimensions and capacity of each pocket in each scow, and the capacity of each pocket when filled with one foot shortage. The above sketches must be accompanied by a sworn statement from the proper officer of the company prosecuting the work that the capacities shown on sketches are correct and authentic.

√ Should the bottom prove unstable for foundation work at the depth heretofore stated, the contractor will be directed by the Chief Engineer to dredge to a greater depth until

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suitable foundation strata is uncovered. Payment for this additional dredging should any be ordered will be made at the unit price bid on the proposal sheet.

(40) Having dredged a suitable trench and obtained a suitable foundation the contractor shall proceed to do the pile driving for deep wall on piles for the approximate distances shown on plan.

These piles shall be driven to a reistance requiring twenty (20) blows to the inch with a 3000 pound hammer and cut off at elevation directed by Chief Engineer, such point of cut off to be at a depth of not less than minus twenty four (24') feet. They shall be spaced about 3'-0" on centres as indicated on "Plan at D".

If conditions developed during progress of dredging to be performed or encountered in driving foundation piles required, contractor shall drive additional piles for base foundation, and bidders will state on their proposal sheet a unit price per pile, for said driving and cutting off at grade shown. Said additional piles, if ordered, shall in all respects conform to requirements for other foundation piles.

When piles are accepted by Chief Engineer, the bottom around them shall be again cleaned with suction pump, and the space around them filled with mass concrete deposited by tremie and carefully levelled. This mass concrete shall be in proportions of 1-2-3.

(41) When piles are driven and cut off to the proper length the contractor shall proceed to lay the bag work foundation for the intervening space of about 135'0", where the concrete blocks shall be set.

(42) The concrete shall be deposited in jute bags? He shall then proceed to set guide rails shown on plan, ten (10') feet between centers by precision instrument measurements, to the required line and grade, properly shimming, fish-plating and anchoring them in rigid position.

(43) Fill all openings beneath rail with small bags of concrete composition as specified for "BAG WORK" and then by depositing concrete composed of one part cement to one part of sand and coarse grit or stone screenings mixed through a "TREMIE" (or tube) proceed to fill between these guide rails.

This mixture shall be of a consistency to flow easily and shall be levelled immediately to a true level plane with a steel faced straight edge, extended across the trams, and handled by two divers or by mechanical means under the supervision of one diver.

No depression or projection will be permitted.

Surface of mass concrete shall be fully equal to similar work on concrete sidewalk when screeded for troweling.

(44) Concrete for BAG WORK shall be a dry mixture unless otherwise ordered, of one part Portland Cement, two parts sand, and three parts by volume of finely broken stone or small gravel.

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thoroughly mixed and bagged immediately before depositing under water.

Should the progress of the work develop the necessity for additional dredging beyond that specified, and should the additional excavation entail the use of greater thickness of mat foundation, the extra bag work required will be paid for at the unit rate stated by contractor on proposal sheet.

(45) The guide rails shall be steel railroad rails, weighing 60 lbs. per yard, laid on side and anchored as directed.

(46) Having finished and leveled the foundation above described, after satisfactory inspection, and seasoning and hardening period of 48 hours; or such other period as may be prescribed by the Chief Engineer, the contractor shall proceed to scour the surface of the foundation work by a hydraulic jet and immediately thereafter shall begin to set the under water blocks. When at least four blocks are set in place the chain grooves shall be filled with 1-2-4 concrete in gunny or cotton sacks of approved size to form a substantial key between the blocks, each sack to be thoroughly rounded in place.

(47) Concrete for these blocks shall be in proportion by volume of one part cement, two parts of sand and four parts of stone or gravel.

(48) Contractor shall begin the casting of these blocks immediately after the award of contract, and before the dredging is started: Each block shall be cast in one complete operation,

and marked with date of casting in a conspicuous place as soon as forms are removed.

(49) Stones or gravel shall be spaded away from the face of forms, and concrete shall be thoroughly tamped.

(50) Surface of concrete blocks shall be uniform and even and show no voids.

(51) As soon as the mass of concrete has set sufficiently to retain its true form without damage, the forms shall be removed and the surface shall be rubbed smooth. A dense impervious front ~~space~~ face is required in said blocks.

(52) Concrete in the blocks must be protected against undue drying influences of sun and wind. If so directed by the Chief Engineer, the blocks shall be sprayed by contractor with fresh water.

(53) The platform on which blocks are cast must be absolutely stable and level, since settlement from the weight of wet concrete in forms will cause distortion of the finished blocks. Contractor will be required to drive sufficient number of piles on reservation alotted to him, to sustain the weight of the number of blocks which he elects to cast in a group for seasoning prior to incorporation in the construction work. The minimum seasoning period for these blocks shall be thirty days.

(54) Sufficient number of forms for casting these blocks, not less than two, must be provided. The forms shall be of steel, suitably braced on the outside to insure the

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concrete finished dimensions shown on plan.

(55) Before casting these blocks the contractor shall submit for approval the plans of forms showing the arrangement for chain grooves, keys, bracing, etc. which may be necessary to obtain satisfactory blocks.

(56) Provision shall be made for casting whatever odd length blocks may be necessary to complete the length of SEA WALL required.

(57) When at least four of the under water blocks are set and keyed as heretofore specified, the construction of the upper eleven (11') of the wall is to be started as shown on the plan, and substantially in accordance with the following method, unless otherwise directed by the Chief Engineer.

(58) The lowest course of rockfaced granite shall be bedded in mortar and placed on top of the cast concrete blocks, and forms of tongued and grooved stock of suitable dimensions and properly braced shall be constructed to insure the finished dimension shown on plan.

(59) The joints between granite and concrete block and forms and concrete blocks shall be made water tight with oakum.

The first stone course shall be laid at lowest practicable state of tide or the forms shall be watertight and kept dry while depositing concrete.

(60) Cramp irons or ties securing the rockfaced granite to concrete shall be placed as shown on the plan, two for each

stretcher and one for each header as the courses are laid, a clearance for the iron ties to rest in being cut in the top of each stone.

(61) Contractor shall proceed to fill the upper part of the forms with concrete of same mixture as for the under-water blocks, and lay and bed the facing stones with cement mortar joints, repeating this process course by course, until the capstone of the SEA WALL is placed.

(62) New concrete joints, occurring when construction is stopped from day to day, must be provided with keys formed by 4" X 6" joists, and the surface cleaned off, and treated with grout before next course of concrete is laid. The joists must be removed before concrete pouring is resumed.

(63) A 15'-0" wide opening shall be left in the upper wall, central between the two islands and finishing the concrete fill behind the granite facing 12" back from the edge of the opening having an incline extending in fifty feet from the face of the SEA WALL. This incline shall be constructed of concrete with reinforcement bars and triangular mesh as approved by Chief Engineer.

(64) Contractor shall drive piles for this incline in two rows 16'-0" apart under the side walls, one row at the extreme inner and central to the 12" wall for same and one through the centre of the 50'-0" distance. These piles shall be of spruce wood, at least 12" butt and 6" point, spaced about 3'-0" on C and cut off at mean low tide. On top of the piles

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build 12" concrete walls, the ones on the sides and at the back reaching up to the finished grade and the one in the centre following the slope of the incline as support for same and extending 1'-0" below mean low tide.

(65) Each wall shall have 3/4" reinforcement bars at the bottom. As shown on plan and section these walls shall be tied and braced by means of two concrete beams running vertically to the walls. They shall be 12" deep at lowest end and 12" thick. Each to have three (3) 3/4" reinforcement bars.

(66) The floor of the incline shall be 6" thick with 1" cement finish, reinforced with 4" triangular mesh at the bottom and extending into the side wall. This mesh shall have No. 6 gauge longitudinal wires and No. 14 gauge diagonals.

(67) The walls shall be 12" thick and integral with the floor of the incline. The face of the side walls towards the incline and the incline itself shall have 1" cement finish.

(68) The lower top edge of the incline shall be at the level of mean low water and the upper one level with the grade.

(69) In the upper part of the sea wall where directed by the Chief Engineer within the space marked 129'-0" on top of under water block, in the second granite course from the top of the block shall be left two holes for sewage or drain pipes, full height of the granite course and 24" wide.

(70) When this portion of the sea wall is constructed the contractor shall proceed with the construction of the two 33'-0" spaces at each end of same.

(71) Across the open space between the crib work of the islands, and the finished sea wall, contractor shall drive 6" X 10" sheet piling with splints to act as front forms flush with the face of the under water blocks and securely braced in place, and suitable back forms as approved.

(72) Similar sheet piling and back forms shall be driven at portion marked "D" for connecting SEA WALL under Contract No. 2 with crib work across dredged trench.

(73) Contractor shall then proceed to fill behind the sheet piling with concrete composed of same proportions cement, sand and gravel as for the blocks, deposited by means of tremie or tube, the base to be not less than 15'0" wide at the bottom and gradually sloping up to about 6'-0" XXXXX at the top which will form a level surface 11'-0" below grade.

(74) On the top of this wall place 1-1/4" rods 9" on centres staggered in four rows as shown on Section "C-C" and extending 3'-0" into the concrete and 3'-0" above same.

(75) Contractor shall then proceed to build the upper eleven (11) feet wall in similar manner as heretofore specified for deep SEA WALL on bag work.

(76) On the southwest front and the southeast end of No. 3 Island contractor shall remove all crib work with fill, face timbers, backing logs, chocks, piles, etc. down to a depth of eleven (11') feet below grade, and proceed to level off for wall on crib work as shown by section.

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(77) At points shown on the southeast end of No. 3 Island where directed by the Chief Engineer and on the southeast end of No. 2 Island cut two trenches in the crib work below the 11'-0" level of required dimensions to install a wooden box 24" square inside, constructed with 3 X 12 timbers, the bottom of the upper wall construction to be cast on top of same. This box shall be properly braced and extend to the extreme back line of the crib work.

(78) Reinforced concrete blocks comprising the wall on crib work shall be cast monolithic with granite facing in forms strongly constructed and braced. These forms may be made either of wood or collapsible steel. The blocks shall be cast directly on top of the crib logs after levelling and preparing. Blocks shall be of shape and size as shown with granite facing similar to other upper wall. The reinforcement bars shall be of size as shown and where indicated on drawing by letter "A" they shall extend outside of the block for a distance of 18 inches into next block. The mixture for these blocks shall be of same proportions as heretofore specified.

(79) At the Southeast end of No. 2 Island remove the platform for casting of blocks and underlying crib work with fill, face timbers, backing logs, piles for crib and for support of platform, etc. down to a depth of eleven (11') feet, same as specified for No. 3 Island and blocks on cribwork, cast same as heretofore specified.

(80) The old rip rap fill from ~~the~~ crib work shall be replaced in back of the cast blocks and in the bays thereof, and additional fill added if required to within 12 inches of grade. The remaining 12 inches shall be filled in either with clean sharp cinders or with first class top loam as may be required to conform with present conditions. The fill shall be sprinkled liberally with water and tamped in place so as to prevent future settlement.

BACKING LOG:

(81) A backing log shall be furnished the entire length of the wall except at the incline.

Timber shall be 9-1/2" X 11-1/2" dressed long leaf yellow pine set flat side down in lengths of not less than 30 feet. The timbers shall be spliced over shims hereafter described by a scarf joint with 24" lap and two 1" bolts. The two upper edges shall be cut to a 1" bevel as shown by section.

12" X 12" yellow pine shims beveled from 2" to 1" thickness, to give a horizontal upper surface, shall be placed under the backing log at intervals of 10 feet C to C.

1" Anchor bolts shall be set in the cap stone 10" from the face and 10' C to C to hold the shims and backing log. Holes in the cap stone shall be 3" or more in diameter, and bolts shall be set in lead to project 9" above the top of the stone (Cinch bolts may be used). Backing log shall be recessed for 3" washers and nuts and the hole shall be tightly plugged with plug 2" deep and planed flush with the surface.

The backing log and blocks for mooring bollards hereafter described shall be painted two coats of white lead and oil. The last coat to be applied at the completion of the work.

MOORING BOLLARDS:

(82) Contractor shall replace the four mooring bollards now in place at the end of No. 2 Island in approximately the same location as before. Bollards shall be mounted on dressed yellow pine blocks 10" X 14" X 72" with broad face down and ends rounded to a 10" radius.

Six 1" bolts shall be provided for each bollard and set as shown on plan, in 3" pipes 12" long, capped by plates and so set in the concrete that the heads remain loose in the holes through the plates. Bolts shall be flush with the nuts when the bollards are bolted down.

GRANITE:

(83) The stone facing is to be a uniform colored granite specifically approved by the Chief Engineer and equal to the approved sample specimen. Except as hereafter specified it shall be square dressed with a rock face. Cap stones are to be bush-hammered and dressed for horizontal joints. Stones shall be laid in courses with alternate headers and stretchers, and with a 1/2" tooled joint, except capstones which shall be set with a 1/4" joint.

Headers shall be 24" long on the face, and stretchers six feet long. Thickness of stones shall be 12" for stretchers d 18" for headers. A variation of 10% will be permitted either way in the length and thickness of headers and stretchers.

The cap stone shall be finished in lengths of eight feet and shall be drilled for bolts of the mooring bollards and backing log.

All stone shall be set to the proper line and grade required.

Mortar for joints shall be one part cement and three parts of sand.

Special granite radial facings and copings shall be furnished and set to form rounded corners for the ninety degree angles formed by the upper wall as shown by plan, details to be approved by Chief Engineer for both granite and concrete backing.

REINFORCEMENT:

All steel reinforcement bars shall be of mild steel to meet the requirements of standard specification of A. S. C. E.

RIP RAP STONE FILL

Should conditions developed during dredging to be performed seem to make necessary, contractor will be required to deposit rip rap filling in rear of SEA WALL after blocks are set or to deposit additional rip rap filling in bays of upper wall on cribs. Bidders will state a unit price per cubic yard for this material dumped in place.

POINTING:

(84) After wall has thoroughly set, all face joints shall be pointed with non staining cement mortar composed of one part cement and two parts of sand.

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CEMENT SAND & AGGREGATE:

(85) Cement shall ~~conform in all respects with~~ to the requirements of U. S. Government specification, as promulgated in Executive Order on April 30th, 1912 and shall be of a brand which has been successfully used in like structures for a period of at least three years.

All sand shall be composed of grains varying from fine to coarse, not over one-eight of an inch in size, it shall be clean, sharp and shall be screened and washed if required.

Gravel for concrete shall be hard, durable clean gravel of approved kind and quality. It shall be of such size as to pass through a two inch hole and not pass through a one half inch hole. Gravel mixed with mud, clay, dirt or quicksand shall be washed before delivery at the job.

Samples of materials to be used in concrete shall be submitted for approval by the Chief Engineer before use in the work.

PROGRESS PHOTOGRAPHS:

(86) Contractor shall furnish two views of the work taken at the end of each month, showing progress thereon. Two carbon prints of each negative to be furnished, mounted on cloth with flap, negatives to be 8" X 10".

CLEANING UP:

(87) After the completion of the work the contractor shall under the direction of the Chief Engineer remove all the debris, forms, sheds, etc. and restore the grounds to a neat condition.

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S P E C I F I C A T I O N

FOR ALL LABOR AND MATERIALS REQUIRED TO CONSTRUCT SECTION OF SEA WALL AT THE U. S. IMMIGRANT STATION, ELLIS ISLAND, N. Y. H. UNDER SEA WALL CONTRACT NUMBER FOUR.

GENERALLY:

(19) Bidders must visit the site, inform themselves of all governing conditions, and include in their estimate all items of labor and materials and plant required or necessarily implied, that may be necessary for the entire completion of the work in accordance with this specification, whether specifically mentioned or not.

(20) DRAWINGS:

One drawing dated at the office of the Commissioner October 1, 1916 and enumerated "PLAN, ELEVATIONS & DETAILS" accompanies this specification.

This specification is intended to supplement the drawing, and, therefore, it will not be the province of this specification to mention any portion of the construction which the drawing is competent to explain, and such omission is not to relieve the contractor from carrying out such portions only indicated on the drawing, and should items be required by the specification not indicated on the drawing they are to be supplied, even if of such nature that they could have been indicated thereon. Any item which may not be indicated on the drawing or mentioned in the specification but are necessary to complete the entire work must be supplied in place.

ENGINEER:

(21) The contractor must employ a competent Civil Engineer and Surveyor to lay out the lines of the proposed Sea Wall and to establish the elevations shown on drawing and called for by this specification. The Contractor will be held responsible for the accurate placing, leveling and alignment of his work and the entire construction must proceed under the supervision of said Civil Engineer.

BENCH MARK:

(22) The bench mark from which levels shall be taken is a small brass plate located on coping of SEA WALL at entrance of Ferry Basin.

BASIS OF PAYMENT:

(23) Payment will be at the unit rate per lineal foot of finished wall, bid by contractor on proposal sheet, including "Backing Log, Bollards, Gangway inclines, etc. for the portion of finished wall installed.

INTENT OF SPECIFICATION:

(24) It is the intent of this specification and drawing to describe and require the construction of a section of deep SEA WALL on bag work 50'0" out from the North East face of the Main Island for a distance of 510 feet with a 45 feet return towards the dock, as indicated on drawing together with dredging and sheet piling.

APPROPRIATION:

(25) The appropriation for this contract (Sea Wall Contract No. 4) is $125,000.00.

DESCRIPTION:

(26) For the under water construction the wall shall be composed of concrete blocks cast and seasoned in the air, together with a mat foundation of concrete bag work.

PLANT REQUIRED:

(27) The Contractor for this work will be required to use floating equipment which is fully capable of handling and setting the under water concrete blocks shown on attached drawing and satisfactory to Chief Engineer. All diving apparatus must be modern and subject to approval by Chief Engineer.

(28) Concrete mixing plant must be of power driven type, specifically approved by the Chief Engineer. Gravity Mixers or continuous mixers will not be permitted. Shed for storage of cement, etc. must be of ample size, of neat appearance, rain-proof, and well constructed.

(29) Arrangements for storage and handling of materials as well as the cast blocks will be subject to the approval of Chief Engineer.

(30) It is required that the concrete blocks specified, be taken from South East end of No. 2 Island, and placed in position by means of a suitable floating derrick and its tackle and gear.

TEMPORARY PRIVY:

(31) The Contractor must provide a suitable temporary privy, for the use of his workmen, to be placed where directed, maintained in a sanitary condition, and at completion of the contract removed and the premises left clean.

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WATER:

(32) Water from the Ellis Island Water Main will be furnished Contractor without charge when the main is in use; but if the water main is broken, or if for any cause an adequate supply for both the U. S. Immigrant Station and the Contractor cannot be obtained from the main, the Contractor must furnish all fresh water required for his plant and work at his own expense. The Contractor shall connect to Water Supply System of the Island where directed by Chief Engineer.

(33) The use of salt water or foul water in making concrete will not be allowed:

CHARACTER OF BOTTOM:

(34) Hydraulic borings are now being made to ascertain the character of the ground likely to be encountered in excavating the foundation trench, and these borings will decide the exact location of the SEA WALL.

The location on the plan showing 50 feet is only approximate and may be changed according to the nature of the bottom developed by the borings.

CONTRACTORS RESERVATION:

(35) The Contractor will be alotted the same space at the South East end of No. 2 Island that was used by Contractor for previous SEA WALL construction for the storage of materials, mixing plant and casting operations.

USE OF DOCK:

(36) The Contractor must so conduct the work that the barges used by the Navy have access to the dock at all times.

INSPECTION:

(37) Contractor shall furnish the Chief Engineer facilities for inspecting the foundation work when requested, and diving and other apparatus so used will be paid for at the regular market rate by the Department of Labor as an extra.

SEQUENCE OF WORK:

(38) Starting 10 feet north west of the old dock for the Baggage & Dormitory building, the Contractor shall start dredging operations and proceed 510 feet South East and 45 feet Southwest, as indicated on drawing, to obtain a trench with a bottom width of not less than 20 feet at a depth of minus thirty (30') feet, as shown on the accompanying drawing. No guarantee is given that the embankments on either side of trench will stand the slope shown by plan, that slope being merely illustrative in a general sense.

Dredging embraces the removal of all materials, except boulders over six cubic feet and solid rock to the depth required, and includes small boulders, loose stones, mud, clay, sand, shells and old logs and piles driven or not driven.

The Government will provide sufficient depth of water to safely float contractor's equipment, such as derrick, mud scows, lighters, etc. outside the lines of trench included in this contract, and payment for the extra dredging entailed will be made at a unit price stated by the Contractor on proposal sheet. This unit price will also apply for trench dredging at over depth.

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Should it be decided to remove any solid rock or boulders over six cubic feet, or should dredging be ordered to over depth, it will be paid for according to unit prices bid by Contractor on proposal sheet.

All dredged materials must be disposed of according to the laws of the United States or of the statutes of the States of New York or New Jersey or the ordinances of the City of New York governing the disposition of this material, and any illegal disposition of material will deprive the Contractor of any payment for the removal of same, and subject him to the legal penalty made and provided for the violation of said laws and ordinances.

All dredged material at over depth will be measured in scows or other vessels used for conveying it away, and any material not so measured before removal will not be paid for.

In payment for removal of solid or ledge rock, place measurements will govern.

The Contractor shall allow ample time to the Chief Engineer in charge or his representative to measure the scows or other vessels used in conveying away the dredged material before the loading of the scows or other vessels is commenced, and the Contractor shall give the Chief Engineer reasonable and sufficient notice prior to the departure of each scow or other vessel containing material dredged under this contract to enable him to examine and measure the dredged material contained therein before it is removed from the vicinity of the work.

Any dredged material reported by Municipal, State or National authorities as not disposed of in accordance with the law will not be paid for unless satisfactory evidence is submitted to the contrary.

Contractor must file at Civil Engineer's office sketch plan or blue print of each scow or other carrying vessel he proposes to use in this work before the commence of operations. These sketches shall show clearly the dimensions and capacity of each pocket in each scow, and the capacity of each pocket when filled with one foot shortage. The above sketches must be accompanied by a sworn statement from the proper officer of the company prosecuting the work that the capacities shown on sketches are correct and authentic.

Should the bottom prove unstable for foundation work at the depth heretofore stated, the Contractor will be directed by the Chief Engineer to dredge to a greater depth until suitable foundation strata is uncovered. Payment for this additional dredging should any be ordered, will be made at the unit price bid on the proposal sheet.

(39) Having dredged a suitable trench and obtained a suitable foundation, the Contractor shall proceed to lay the bag work foundation for the concrete blocks.

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(40) The concrete shall be deposited in jute bags. He shall then proceed to set guide rails shown on plan, ten (10') feet between centers by precision instrument measurements, to the required line and grade, properly shimming, fish-plating and anchoring them in rigid position.

(41) Fill all openings beneath rail with small bags of concrete composition as specified for "BAG WORK" and then by depositing concrete composed of one part cement to one part of sand and coarse grit or stone screenings mixed through a "TREMIE" (or tube) proceed to fill between these guide rails.

This mixture shall be of a consistency to flow easily and shall be levelled immediately to a true level plane with a steel faced straight edge, extended across the trams, and handled by two divers or by mechanical means under the supervision of one diver.

No depression or projection will be permitted.

Surface of mass concrete shall be fully equal to similar work on concrete sidewalk when screeded for troweling.

(42) Concrete for BAG WORK shall be a dry mixture unless otherwise ordered, of one part Portland Cement, two parts sand, and three parts by volume of finely broken stone or small gravel thoroughly mixed and bagged immediately before depositing under water.

Should the progress of the work develop the necessity for additional dredging beyond that specified, and should the additional excavation entail the use of greater

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thickness of mat foundation, the extra bag work required will be paid for at the unit rate stated by Contractor on proposal sheet.

(43) The guide rails shall be steel railroad rails, weighing 60 lbs. per yard, laid on side and anchored as directed.

(44) Having finished and leveled the foundation above described, after satisfactory inspection and seasoning and hardening period of 48 hours, or such other period as may be prescribed by the Chief Engineer, the Contractor shall proceed to scour the surface of the foundation work by a hydraulic jet and immediately thereafter shall begin to set the under water blocks. When at least four blocks are set in place, the chain grooves shall be filled with 1-2-4 concrete in gunny or cotton sacks of approved size to form a substantial key between the blocks, each sack to be thoroughly rounded in place.

(45) Concrete for these blocks shall be in proportion by volume of one part cement, two parts of sand and four parts of stone or gravel.

(46) Contractor shall begin the casting of these blocks immediately after the award of contract and before the dredging is started. Each block shall be cast in one complete operation and marked with date of casting in a conspicuous place as soon as forms are removed.

(47) Stones or gravel shall be spaded away from the face of forms and concrete shall be thoroughly tamped.

(48) Surface of concrete blocks shall be uniform and even and show no voids.

(49) As soon as the mass of concrete has set sufficiently to retain its true form without damage, the forms shall be removed and the surface shall be rubbed smooth. A dense impervious front face is required in said blocks.

(50) Concrete in the blocks must be protected against undue drying influences of sun and wind. If so directed by the Chief Engineer, the blocks shall be sprayed by Contractor with fresh water.

(51) The platform on which blocks are cast must be absolutely stable and level, since settlement from the weight of wet concrete in forms will cause distortion of the finished blocks. Contractor will be required to drive sufficient number of piles on reservation alotted to him, to sustain the weight of the number of blocks which he elects to cast in a group for seasoning prior to incorporation in the construction work. The minimum seasoning period for these blocks shall be thirty days.

(52) Sufficient number of forms for casting these blocks, not less than two, must be provided. The forms shall be of steel suitably braced on the outside to insure the concrete finished dimensions shown on plan.

(53) Before casting these blocks, the Contractor shall submit for approval the plans of forms showing the arrangement

for chain grooves, keys, bracing, etc. which may be necessary to obtain satisfactory blocks.

(54) Provision shall be made for casting whatever odd length blocks may be necessary to complete the length of SEA WALL required.

(55) When at least four of the under water blocks are set and keyed as heretofore specified, the construction of the upper eleven (11') feet of the wall is to be started as shown on the plan, and substantially in accordance with the following method, unless otherwise directed by the Chief Engineer.

(56) The lowest course of rockfaced granite shall be bedded in mortar and placed on top of the cast concrete blocks, and forms of tongued and grooved stock of suitable dimensions and properly braced shall be constructed to insure the finished dimensions shown on plan.

(57) The joints between granite and concrete block and forms and concrete blocks shall be made watertight with oakum.

The first stone course shall be laid at lowest practicable state of tide or the forms shall be watertight and kept dry while depositing concrete.

(58) Cramp irons or ties securing the rockfaced granite to concrete shall be placed as shown on the plan, two for each stretcher and one for each header as the courses are laid, a clearance for the iron ties to rest in being cut in the top of each stone.

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(59) Contractor shall proceed to fill the upper part of the forms with concrete of same mixture as for the under-water blocks, and lay and bed the facing stones with cement mortar joints, repeating this process course by course until the capstone of the SEA WALL is placed.

(60) New concrete joints occurring when construction is stopped from day to day must be provided with keys formed by 4" X 6" joists, and the surface cleaned off, and treated with grout before next course of concrete is laid. The joists must be removed before concrete pouring is resumed.

(61) Two 8'-0" wide openings shall be left in the upper Sea Wall and shall gave a depth of 6'0" as indicated on drawing. These openings for gangways shall be located opposite the present gangways leading to the Baggage and Dormitory Bldg.

(62) As indicated on drawing of gangway, the granite blocks around the opening shall have bush hammer finish for all exposed surfaces.

(63) The Contractor shall leave holes for sewage and drainage of size, number and locacility, as will be directed by the Chief Engineer.

BACKING LOG:

(64) A backing log shall be furnished the entire length of the wall except at the gangways.

Timber shall be 9-1/2" X 11-1/2" dressed long leaf yellow pine, set flat side down in lengths of not less than thirty (30') feet. The timbers shall be spliced over shims hereafter described by a scarf joint with 24" lap and two 1" bolts. The two upper edges shall be cut to a 1" bevel as shown by section.

12" X 12" yellow pine shims beveled from 3" to 1" thickness, to give a horizontal upper surface, shall be placed under the backing log at intervals of 10 feet C to C.

1" Anchor bolts shall be set in the capstone 10" from the face and 10' C to C to hold the shims and backing log. Holes in the cap stone shall be 3" or more in diameter, and bolts shall be set in lead to project 9" above the top of the stone. (Clinch bolts may be used). Backing log shall be recessed for 3" washers and nuts and the hole shall be tightly plugged with a plug 3" deep and planed flush with the surface.

The backing log and blocks for mooring bollards hereafter described shall be painted two coats of white lead and oil. The last coat to be applied at the completion of the work.

MOORING BOLLARDS:

(65) Contractor shall remove the Mooring bollards now in place on the Southwest side of No. 2 Island, and ten of these bollards shall be placed on the new Sea Wall approximately 50 feet apart or as directed by the Chief Engineer. The placing of bollards shall be included in the price for deep Sea Wall per lineal foot. Bollards shall be mounted on dressed yellow pine blocks 10" X 14" X 72" with broad face down and ends rounded to a 10" radius.

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Six 1" bolts shall be provided for each bollard and set as shown on plan, in 3" pipes 13" long, capped by plates and so set in the concrete that the heads remain loose in the holes through the plates. Bolts shall be flush with the nuts when the bollards are bolted down.

GRANITE:

(66) The stone facing is to be a uniform colored granite specifically approved by the Chief Engineer and equal to the approved sample specimen. Except as hereafter specified it shall be square dressed with a rock face. Cap stones are to be bush-hammered and dressed for horizontal joints. Granite around gangways shall have exposed surfaces bush-hammered.

Stones shall be laid in courses with alternate headers and stretchers, and with a 1/2" tooled joint, except cap stones which shall be set with a 1/4" joint.

Headers shall be 24" long on the face, and stretchers six feet long. Thickness of stones shall be 12" for stretchers and 18" for headers. A variation of 10" will be permitted either way in the length and thickness of headers and stretchers.

The cap stone shall be finished in lengths of eight feet and shall be drilled for bolts of the mooring bollards and backing log.

All stone shall be set to the proper line and grade required.

Mortar for joints shall be one part cement and three parts of sand.

Special granite radial facings and copings shall be furnished and set to form rounded corner for the ninety degree angle formed by the upper wall as shown by plan, details to be approved by Chief Engineer for both granite and concrete backing.

SHEET PILING:

(67) At the 90° corner shown by detail drawing, Contractor shall drive sheet piling at the same angle as the face of the concrete blocks. These piles shall consist of three (3") inches thick planks 12" wide. They shall be driven in such a proximity that when at the correct slope the tops shall come together two feet above mean low water and securely spiked together by means of cleats on the outside. The inside of this sheet piling shall then be made into a closed form by means of boards shaped to fit at the piles and secured to same.

The key at the back of the concrete blocks shall have vertical sheet piling securely joined together at the top.

If necessary the inner and outer sheet piling shall be braced by means of 1-1/4" tie rods with washers.

The enclosed space thus formed between the sheet piling and the ends of the concrete blocks shall then be filled with mass concrete, of same consistence as mass concrete in foundation for the blocks, up to the level of the blocks, and shaped and grooved similar to the top of the blocks.

RIP RAP STONE FILL:

(68) Should conditions developed during dredging to be performed seem to make necessary, contractor will be required to deposit rip rap filling in rear of SEA WALL after blocks are set. Bidders will state a unit price per cubic yard for this material dumped in place.

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POINTING:

(69) After wall has thoroughly set, all face joints shall be pointed with non staining cement mortar composed of one part cement and two parts of sand.

CEMENT SAND & AGGREGATE:

(70) Cement shall conform in all respects with to the requirements of U. S. Government specification, as promulgated in Executive Order on April 30th, 1912 and shall be of a brand which has been successfully used in like structures for a period of at least three years.

All sand shall be composed of grains varying from fine to coarse, not over one-eighth of an inch in size, it shall be clean, sharp and shall be screened and washed if required.

Gravel for concrete shall be hard, durable clean gravel of approved kind and quality. It shall be of such size as to pass through a two inch hole and not pass through a one half inch hole. Gravel mixed with mud, clay, dirt or quicksand shall be washed before delivery at the job.

Samples of materials to be used in concrete shall be submitted for approval by the Chief Engineer before use in the work.

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SPECIFICATION

FOR ALL LABOR AND MATERIALS REQUIRED TO CONSTRUCT SECTION OF SEA WALL AT THE U. S. IMMIGRANT STATION, ELLIS ISLAND, N. Y. H., UNDER SEA WALL CONTRACT NUMBER FIVE.

GENERALLY.

(19) Bidders must visit the site; inform themselves of all governing conditions, and include in their estimate all items of labor and materials, and plant required or necessarily implied, that may be necessary for the entire completion of the work in accordance with the specification, whether specifically mentioned or not.

(20) This specification is intended to supplement the drawing, and, therefor, it will not be the province of this specification to mention any portion of the construction which the drawing is competent to explain; and such omission is not to relieve the contractor from carrying out such portions only indicated on the drawing; and should items be required by the specification not indicated on the drawing, they are to be supplied, even if of such nature that they could have been indicated thereon. Any items which may not be indicated on the drawing or mentioned in the specification, but are necessary to complete the entire work, must be supplied in place.

(21) The contractor must employ a competent Civil Engineer and Surveyor to lay out the lines of the proposed sea wall, and to establish the elevations shown on drawing and called for by the specification. The contractor will be held responsible for the accurate placing, leveling and alignment of his work, and the entire

construction must proceed under the supervision of said Civil Engineer.

BENCH MARK.

(22) The bench mark from which the levels shall be taken is a small brass plate located on coping of sea wall at ferry-house.

DRAWING.

(23) One drawing governing this work, and dated at the office of the Commissioner March 14, 1920, accompanies this specification, and is designated as follows:

897/1 Plans, Elevations and Details.

BASIS OF PAYMENT

(24) Payment will be at the unit rate of the following items: Price per lineal foot of finished deep sea wall on bag-work; price per lineal foot of shallow wall on rip rap, including concrete slab and piles, and price per cubic yard of rip rap in place; together with such overdepth work, requiring payment as may develop during progress of the work. The extent of the work will be governed entirely by the amount of the appropriation after payments for necessary dredging are deducted therefrom.

INTENT OF SPECIFICATION.

(25) It is the intent of this specification and drawing to describe and require the construction of a section of deep sea wall on bag-work as continuation from northerly end of sea wall contract

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Number 4 at "A", for a distance of 85 feet from "A" to "B"; and then at right angle to same from "B" to "C" for a distance of 25 feet due south-west including a rounded corner on piles at "B"; and an inside corner on piles at "C" thence at right angle due north-west from "C" to "D" for a distance of 220 feet, including a rounded corner on piles at "D"; thence at right angle due south-west from "D" to "E" for a distance of 25 feet, including necessary pile driving and sheet piling; thence at right angle due south-west from "E" to "F" for a distance of about 585 feet more or less, as the appropriation may permit, shallow wall on rip rap, including rip rap fill and pile driving.

SEQUENCE OF WORK

(26) After suitable trench has been dredged under another contract this contractor shall start his under watsr work at point "A" and proceed to point "B", thence to point "C" and from "C" to "D" etc. The first blocks to be set for the deep wall will be between the points "C" and "D", starting at either end, and the gap between points "A" and "C" must remain open to permit the passage of coal and passenger barges behind the new wall until the Government erects temporary bridges from buildings to face of "Sea Wall Contract No. 4" to land baggage therefrom, and makes necessary changes in coal hoist to permit the unloading of fuel from the front of new wall. This bridging and removal

of coal hoist will be undertaken by the Government as the section of new wall between points "C" and "D" nears completion. Contractor may meanwhile carry on his operations between points "D" and "E". Any delays at the hands of the Government will be covered by an extension of time limit.

(27) The appropriation available for this contract (Sea Wall Contract Number 5) is approximately $160,000, including necessary dredging.

(28) For the deep sea wall construction the wall shall be composed of concrete blocks cast and seasoned in the air, together with a mat foundation of concrete bag-work, for distances as noted on the drawing; the corners to be supported on piles; and the granite facing for the upper 11 feet to be backed with concrete poured in its permanent location as shown by details.

The shallow wall on rip rap shall be supported on piles, with a concrete slab 12" thick and 7' - 0" wide. The upper 11 feet granite facing to be backed by concrete poured in its permanent location as shown by detail drawing.

PLANT REQUIRED.

(29) The contractor for this work will be required to use floating equipment which is fully capable of handling and setting the under water concrete blocks shown on drawings and satisfactory to the Chief Engineer., For the shallow-wall he

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may elect to use whatever he deems fit for the purpose. All diving apparatus must be modern and subject to approval by Chief Engineer.

(30) Concrete mixing plant must be power driven type specifically approved by the Chief Engineer. Gravity mixers or continuous mixers will not be permitted. Shed for storage of cement, etc., must be of ample size, of neat appearance, rain proof, and well constructed.

Arrangements for storage and handling of materials, as well as the cast blocks, will be subject to the approval of Chief Engineer.

TEMPORARY PRIVY.

(31) The contractor must provide a suitable temporary privy for the use of his workmen, to be placed where directed, maintained in sanitary condition, and at completion of the contract removed and the premises left clean.

WATER.

(32) Water from Ellis Island water main will be furnished the contractor without charge when the main is in use; but if the water main is broken, or if for any cause an adequate supply for both the U. S. Immigrant Station and the contractor, cannot be obtained from the main, the contractor must furnish all

fresh water required for his plant and work at his own expense. The contractor shall connect the water supply system of the Island where directed by Chief Engineer.

(33) The use of salt water or foul water in making concrete will not be allowed.

(34) Borings and soundings are now being made, and the contractor will be furnished with complete data and profiles of same. The borings may change location of sea wall as shown on location plan.

CONTRACTOR'S RESERVATION.

(35) The contractor will be allotted space for platform on which to cast the under water blocks. This platform must be absolutely stable and level, since settlement from the weight of wet concrete in forms will cause distortion of the finished blocks. Contractor will be required to drive sufficient number of piles on reservation allotted to him to sustain the weight of the number of blocks which he elects to cast in a group for seasoning prior to incorporation into the construction work.

(36) It should be borne in mind that the minimum seasoning period specified for these blocks is 30 days. See paragraph (52)

(37) This platform shall be framed and decked in substantial manner, according to plan approved by Chief Engineer. A bearing value of ten tons will be allowed for each pile under platform.

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USE OF NORTH EAST CHANNEL

(38) The contractor must so conduct the work that navigation or the transfer of coal and passenger barges will not be interfered with. (See paragraph 26).

INSPECTION.

(39) Contractor shall furnish the Chief Engineer facilities for inspecting the foundation work when requested, and diving and other apparatus so used will be paid for at the regular market rate by the Department of Labor, as an extra.

DREDGING

(40) Dredging will be performed by another contractor and the Government will provide a suitable trench for deep wall with a bottom width of not less than 20 feet ata depth of minus 30 feet, over the lines described or shown as well as sufficient depth of water outside the lines of deep sea wall to float contractor's equipment used in setting the deep water blocks. However, no dredging will be performed in the vicinity of shallow wall on rip rap and piles, and this contractor must therefore make his own arrangements to complete this part of the work as shown on the drawings.

After dredging is completed this contractor shall remove inflow from trench by means of hydraulic suction hose handled by divers, and shall then immediately proceed to lay the bag work for the under water blocks.

41. The concrete for bag work shall be deposited in jute bags. He shall then proceed to set guide rails shown on plan, ten (10) feet between centers by precision instrument measurements, to the required line and grade, properly shimming, fish plating and anchoring them in rigid position.

42. The guide rails shall be steel railroad rails weighing 60 lbs per yard laid on side as shown on section.

43. Fill all openings beneath rail with small bags of concrete composition as specified for "Bag Work", and then by depositing concrete composed of one part cement to two parts of sand and coarse grit or stone screenings mixed, through a "Tremic" (or tube) proceed to fill between these guide rails.

This mixture shall be of consistency to flow easily and shall be leveled immediately to a true level plane with steel faced straight edge, extended across the trams and handled by two divers or by mechanical means under the supervision of one diver. No depression or projection will be permitted. Surface of mass concrete shall be fully equal to similar work on concrete sidewalk when screeded for troweling.

44. Concrete for bag work shall be a dry mixture unless otherwise ordered, of one part Portland Cement, two parts of sand and three parts by the volume of finely broken stone or small gravel thoroughly mixed and bagged immediately before depositing under water.

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Should the progress of the work develop the necessity for additional dredging beyond that specified, and should the additional excavation entail the use of greater thickness of mat foundation, the extra bag work required will be paid for at the unit rate stated by contractor on proposal sheet.

45. Having finished and leveled the foundation above described, after satisfactory inspection, and seasoning and hardening period of 48 hours, or such other period as may be prescribed by the Chief Engineer, the contractor shall proceed to scour the surface of the foundation work by a hydraulic jet and immediately thereafter shall begin to set the under water blocks. When at least four blocks are set in place, the chain grooves shall be filled with 1-2-4 concrete in gunny or cotton sacks of approved size to form a substantial key between the blocks, each sack to be thoroughly pounded in place.

46. Concrete for these blocks shall be in proportion by volume of one part cement, two parts of sand and four parts of stone or gravel.

47. Contractor shall begin the casting of these blocks immediately after the award of contract. Each block shall be cast in one complete operation, and marked with date of casting in a conspicuous place as soon as forms are removed.

48. Stones or gravel shall be spaded away from the face of

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forms, and concrete shall be thoroughly tamped.

49. Surface of concrete blocks shall be uniform and even and show no voids.

50. As soon as the mass of concrete has set sufficiently to retain its true form without damage, the forms shall be removed and the surface shall be rubbed smooth. A dense impervious front face is required in said blocks.

51. The minimum seasoning period for these blocks shall be thirty days.

52. Sufficient number of forms for casting these blocks, not less than two, must be provided. The forms shall be of steel, suitably braced on the outside to insure the concrete finished dimensions shown on plan.

53. Before casting these blocks the contractor shall submit for approval the plans of forms showing the arrangement for chain grooves, keys, bracing, etc., which may be necessary to obtain satisfactory blocks.

54. Provision shall be made for casting whatever odd length blocks may be necessary to complete the length of sea wall required.

55. When at least four of the under water blocks are set and keyed as heretofore specified, the construction of the upper eleven (11') feet of the wall is to be started, as shown on the plan, and substantially in accordance with the following method, unless otherwise directed by the Chief Engineer,

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56. The lowest course of rock faced granite shall be bedded in mortar and placed on the top of the cast concrete blocks, and forms of tongue and grooved stock of suitable dimensions, and properly braced, shall be constructed to insure the finished dimension shown on plan.

57. The joints between granite and concrete block, and forms and concrete block, shall be made water tight with oakum. The first stone course shall be laid at lowest practicable state of tide or the forms shall be watertight and kept dry while depositing concrete.

58. Cramp irons or ties securing the rockfaced granite to concrete and reinforcement bars 1 1/4" diam shall be placed as shown on plan. Cramps shall be two for each stretcher and one for each header as the courses are laid, a clearance for the iron ties to rest in being cut in the top of each stone. These ties shall be securely wired to the reinforcement bars.

59. Contractor shall proceed to fill the upper part of the forms with concrete of same mixture as for the under-water blocks, and lay and bed the facing stones with cement mortar joints, repeating this process course by course, until the capsone of the sea wall is placed.

60. New concrete joints, occuring when construction is stopped from day to day, must be provided with keys formed by 4" x 6" joints, and the surface cleaned off, and treated with grout before next course

of concrete is laid. The joists must be removed before concrete pouring is resumed.

61. When this part of the wall is completed the contractor shall proceed to form the rounded or inside corners for deep sea wall. The piles shall be spaced and cut to proper grade as shown on plan. Across and around the open space forming the corner Contractor shall drive sheet piling or set forms to shape the corner as indicated on plan and to the satisfaction of the Chief Engineer.

62. Contractor shall then proceed to fill in with concrete composed of same proportions cement, sand and gravel as for the blocks, deposited by means of "tremic" or tube, the base to be not less than 15'-0" wide at the bottom and gradually sloping up to the top as shown on plan.

63. At the elevation of 10'-0" the contractor shall set 1-1/4" diam. vertical reinforcement bars 6'-0" long extending 3'-0" above said elevation spaced 9" on centres staggered in four rows.

64. Contractor shall then proceed to build the upper eleven (11') feet wall in similar manner as heretofore specified but with the granite blocks and capping-stone formed to fit the radii of the courses.

65. The continuation of the deep sea wall shall be shallow wall on rip rap constructed as shown by 1/2" scale detail.

66. Contractor shall proceed to drive piles in two parallel rows 3'-0" on centres, and the piles in each of these rows to be spaced

6'-0" on centres either in pairs or staggered as will be directed by the chief engineer. These piles shall be out off at an elevation of 12'-0" below grade.

Piles for the rounded and inside corners shall be driven as spaced on plan and cut off at grade minus 29'.

67. When the piles are in place the contractor shall fill in with rip rap around same, forming a bed for the shallow wall, the fill to have a width at the top of approximately 15'-0" with natural slope of the sides. Top of rip rap shall be flush with top of the piles.

68. On top of the rip rap and properly braced and securely held in place contractor shall set forms for the 7'-0" x 1' 0" continuous concrete slab. Before pouring concrete for same contractor shall fill all openings in rip rap with broken stone and gravel to form a level bed.

69. The depositing of the concrete shall be done at the lowest practicable state of tide and the contractor shall follow up the operations carefully and replenish the concrete where seeping shows to obtain a level bed for the upper 11'-0" of wall.

70. The granite facing with concrete backing shall then be set in same manner as specified for deep sea wall.

BACKING LOG.

71. A backing log shall be furnished the entire length of wall.

Timber shall be 9 1/2" x 11 1/2" dressed long leaf yellow pine set broad side down in lengths of not less than 30'-0". The timbers shall be spliced over shims hereafter described by a scarf joint with 24" lap and two 1" bolts. The two upper edges shall be cut to a 1" chamfer as shown by section. 12" x 12" yellow pine shims beveled from 2" to 1" thickness, to give a horizontal upper surface, shall be placed under the backing log at intervals of 10'-0" C to C. 1" anchor bolts shall be set in the cap stone 10" from the face 10'-0" C to C to hold the shims and backing log. Holes in the cap stone shall be 2" or more in diameter and bolts shall be set in lead to project 9" above the top of the stone (Cinch bolts may be used). Backing log shall be recessed for 3" washers and nuts and hole shall be tightly plugged with a plug 2" deep and planed flush with the surface.

The backing log and blocks for mooring bollards hereafter described shall be painted two coats of white lead and oil. The last coat to be applied at the completion of the work.

MOORING BOLLARDS.

72. Contractor shall remove four or more of the old mooring bollards located on the rear bulkhead of No. 2 Island and place same as will be directed by the Chief Engineer.

Bollards shall be mounted on dressed yellow pine blocks 10" x 14" x 72" with broad face down and ends rounded to a ten inch radius.

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Six 1" bolts shall be provided for each bollard in 3" pipes 12" long, capped by plates and so set in the concrete that the bolts remain loose in the holes through the plates. Boltheads shall be flush with the top of the base plate of the Bollards, when they are bolted down.

GRANITE

73. The stone facing is to be of a uniform colored granite specifical approved by the Chief Engineer and equal to the approved sample specimen. Except as hereafter specified it shall be square dressed with a rock face. Cap stones shall be bush-hammered and dressed for horizontal joints. Stones shall be laid in courses with alternate headers and stretchers, and with a 1/2" tooled joint, except cap stones which shall be set with 1/4" joint.

Headers shall be 24" long on the face, and stretchers six feet long. Thickness of stones shall be 12" for stretchers and 18" for headers. A variation of 10% will be permitted either way in the length and thickness of headers and stretchers.

The cap stone shall be finished in lengths of eight feet and shall be drilled for bolts of the mooring bollards and backing log.

All stones shall be set to the proper line and grade required.

Mortar for joints shall be one part cement and three parts of sand.

Special granite radial facings and copings shall be furnished and set to form rounded corners for the ninety degree angles formed by the wall as shown on plan. Details to be approved by the Chief Engineer for both granite and concrete backing.

REINFORCEMENT

74. All steel reinforcement shall be of mild steel to meet the requirements of standard specification of A. S. C. E.

RIP RAP STONE FILL

75. Rap rap shall be deposited as a bed for shallow wall as shown by detail drawing on plan and underneath the incline. Bidder shall state a unit price per cubic yard for this material dumped in place.

POINTING

76. After wall has thoroughly set, all face joints shall be pointed with non staining cement mortar composed of one part cement and two parts of sand.

CEMENT, SAND AND AGGREGATE

77. Cement shall conform in all respects with the requirements of U. S. Government Specification, as promulgated in Executive order on April 30th, 1912 and shall be of brand which has been successfully used in like structures for a period of at least three years.

All sand shall be composed of grains varying from fine to coarse, not over one-eighth of an inch in size, it shall be clean, sharp and shall be screened and washed if required.

Gravel for concrete shall be hard, durable clean gravel of approved kind and quality. It shall be of such size as to pass through a two inch hole and not pass through a one half inch hole.

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Gravel mixed with sand, clay, dirt or quicksand shall be washed before delivery at the job. Samples of materials to be used in concrete shall be submitted for approval by the Chief Engineer before use in the work.

PROGRESS PHOTOGRAPHS

78. Contractor shall furnish two views of the work taken at the end of each month, showing progress thereon. Two carbon prints of each negative to be furnished, mounted on cloth with flap, negatives to be 8" x 10".

CLEANING UP

79. After the completion of the work the contractor shall under the direction of the Chief Engineer remove all debris, forms, sheds, platform for casting of the blocks etc., and restore the grounds to neat condition. The piles driven as supports for the platform need not be pulled but they shall have the tops cut off to 18" below grade.

Ellis Island, N. Y. H., May 19, 1920.

APPENDIX D.

Technical Excerpt, Specification for the Construction of Seawall, November 7, 1933

From File 202, Box 9, RG 79, NARA NYC

[illegible]

DEMOLITION

61. BIDDERS SHOULD EXAMINE THE PREMISES OF THE [illegible] AND INFORM THEMSELVES AS TO ITS CHARACTER AND THE [illegible] TO BE REMOVED. FAILURE TO TAKE THIS PRECAUTION [illegible] THE SUCCESSFUL BIDDER FROM THE NECESSITY OF [illegible] AND LABOR NECESSARY TO COMPLETE THE CONTRACT WITHOUT [illegible] TO THE GOVERNMENT.

62. THE CONTRACTOR SHALL TAKE THE SITE AS HE FINDS [illegible] SHALL REMOVE ALL OLD STRUCTURES SO INDICATED ON DRAWING NO. [illegible]

63. BIDDERS SHALL TAKE INTO ACCOUNT THE SALVAGE VALUE [illegible] THEM OF MATERIALS REMOVED, AND SUCH VALUE SHALL BE REFLECTED IN [illegible]

64. ALL RUBBISH AND DEBRIS FOUND ON THE SITE AND RESULTING FROM THE WORK OF DEMOLITION SHALL BE REMOVED FROM THE PREMISES.

65. ALL MASONRY MATERIAL TO BE REMOVED SHALL BE DRENCHED BEFORE OR DURING ITS REMOVAL AS MAY BE NECESSARY TO PREVENT DUST FROM RISING FROM THE MATERIALS WHEN HANDLED.

66. WATER SERVICE PIPING IN BUILDINGS SHALL BE REMOVED BACK TO THE POINT OF ENTRY AND CAPPED OR PLUGGED. DRAIN PIPING IN BUILDING SHALL BE REMOVED AND SEWER CONNECTIONS CAPPED OR PLUGGED, AS DIRECTED.

67. THE CONTRACTOR SHALL NOTIFY THE OWNERS OF ALL OTHER PIPES, WIRES, AND ETC., SUPPLYING SERVICE TO ANY OF THE BUILDINGS TO DISCONNECT SUCH PIPES AND WIRES AND TO REMOVE ANY METERS OR OTHER EQUIPMENT BELONGING TO SUCH OWNERS. SUCH SERVICE LINES AND EQUIPMENT FOR WHICH NO OWNERSHIP IS CLAIMED, SHALL BE REMOVED BY THE CONTRACTOR AND PROPERLY TERMINATED.

DREDGING, EXCAVATING, FILLING, RIP RAP, ETC.

63. DREDGING.--THE EXTENT OF DREDGING IS SHOWN ON DRAWING NO. 1-401. DREDGING SHALL INCLUDE THE REMOVAL OF ALL MATERIAL INCLUDING WRECKS, PILES (IF ANY) STONES, SHELLS, SAND, SILT, ETC., TO THE DEPTHS INDICATED.

69. DREDGED MATERIAL FREE FROM PERISHABLE RUBBISH SHALL BE USED FOR FILLING WHERE SO NOTED ON THE DRAWINGS.

70. EXCAVATION.--ALL EXCAVATION SHALL BE DONE AND WITH SUFFICIENT WORKING SPACE TO PERMIT THE PLACING, INSPECTION, AND COMPLETION OF ALL WORK EMBRACED IN THE CONTRACT. EXCAVATED MATERIAL THAT IS UNSUITABLE OR NOT REQUIRED FOR FILLING OR GRADING SHALL BE REMOVED FROM THE PREMISES.

71. THE SIDES OF EXCAVATIONS SHALL BE TEMPORARILY SUPPORTED AND MAINTAINED SECURE UNTIL PERMANENT SUPPORT IS PROVIDED.

72. FILLING AND GRADING.--EXCAVATIONS BELOW THE FINISHED GRADES SHALL BE BACK FILLED WITH SUITABLE MATERIAL FREE FROM PERISHABLE RUBBISH. ALL TEMPORARY PLANKING, TIMBERING, ETC., SHALL BE REMOVED AS THE BACK FILL IS PLACED.

73. NO BACKFILLING SHALL [illegible] UNTIL SO DIRECTED. [illegible] CAVING OF EXCAVATIONS THAT MAY OCCUR OR ANY BACK FILL PLACED BEFORE INSPECTIONS ARE COMPLETE SHALL BE REMOVED [illegible] IN THE OPINION OF THE [illegible] ENGINEER. [illegible]

74. [illegible] BACKFILL OVER [illegible] SHALL BE CLEAN, HARD [illegible] BROKEN STONE THAT WILL PASS A 3 INCH [illegible] AND BE RETAINED [illegible] MESH SCREEN.

75. FILL ~~BOTH~~ Back OF PILES AND WHERE OTHERWISE INDICATED SHALL BE TAKEN FROM SPACE BETWEEN ISLANDS NOS. 2 AND 3. SEE NOTES AND DETAILS ON DRAWINGS.

76. THE SPACE BETWEEN ISLANDS NOS. 2 AND 3 SHALL BE EXCAVATED TO THE ELEVATION INDICATED AND THEN FILLED TO A DEPTH OF 1 FEET SIX INCHES WITH CLEAN EARTH PLACED IN EVENLY DISTRIBUTED LAYERS OVER ENTIRE AREA. THE ENTIRE AREA SHALL THEN BE SURFACED WITH GOOD QUALITY TOP SOIL TO A DEPTH OF 6 INCHES. ALL SUCH SURFACES SHALL BE RAKED SMOOTH AND FREE FROM STICKS, STONES OR CLODS.

76-A. ALL FILL AND BACKFILLING SHALL BE PLACED IN HORIZONTAL LAYERS NOT OVER 8 INCHES IN DEPTH. EACH LAYER SHALL BE THOROUGHLY TAMPED, PACKED, OR PUDDLED, AS DIRECTED, SO THAT NO SETTLEMENT SHALL OCCUR.

77. ALL GRADING SHALL BE DONE AS REQUIRED TO BRING THE GROUNDS TO THE FINISHED GRADES. GRADES NOT OTHERWISE INDICATED SHALL BE UNIFORM LEVELS OR SLOPES BETWEEN POINTS WHERE ELEVATIONS ARE GIVEN, OR BETWEEN SUCH POINTS AND EXISTING FINISHED GRADES.

78. RIP RAP.--RIP RAP SHALL BE COMPOSED OF GRANITE OR EQUALLY DURABLE BOULDERS OF NOT LESS THAN 50 POUNDS EACH AND SHALL BE PLACED SUCH THAT THE RIP RAP WILL BE COMPARATIVELY HOMOGENEOUS AND THE FACE STONE WELL BANDED TOGETHER.

79. CONCRETE BAG WORK.—CONCRETE SHALL BE AS SPECIFIED UNDER "CEMENT, AGGREGATES AND MIXTURES" AND SHALL BE PLACED IN BURLAP BAGS AND LAID UP BY HAND AS SHOWN. PLAIN CONCRETE MAY BE SUBSTITUTED FOR THE BAG WORK BY PROVIDING SHEET PILING COTTER DAM AND PLACING THE CONCRETE AS SPECIFIED UNDER "CONCRETE WORK" AT THE OPTION OF THE CONTRACTOR.

CEMENT, AGGREGATES AND MIXTURES

80. PORTLAND CEMENT SHALL COMPLY WITH FEDERAL SPECIFICATION NO. SS-C-191, EXCEPT THAT THE 28 DAY TEST WILL BE WAIVED. WHITE CEMENT SHALL BE NON-STAINING PORTLAND CEMENT.

81. IF THE AMOUNT OF THE CEMENT REQUIRED IS MORE THAN 1,000 BBLS., AND LESS THAN 5,000 BBLS. THE USE OF MILL TESTED CEMENT SHALL BE OPTIONAL WITH THE CONTRACTOR. IF THE AMOUNT OF THE CEMENT REQUIRED IS 5,000 BBLS. OR MORE, THE CEMENT SHALL BE MILL TESTED. CEMENT WILL NOT BE MILL TESTED IN QUANTITIES OF LESS THAN 1,000 BBLS.

82. MILL TESTED CEMENT SHALL BE TESTED AND PASSED AT THE MILL BY A GOVERNMENT INSPECTOR, OR SHALL BE TAKEN FROM GOVERNMENT TESTED AND SEALED BINS. EACH SHIPMENT SHALL BE CERTIFIED BY A GOVERNMENT INSPECTOR THAT THE CEMENT COMPLIES WITH FEDERAL SPECIFICATION, AND SHALL BE SEALED OR TAGGED OR OTHERWISE IDENTIFIED AS CERTIFIED MATERIAL.

83. The contractor shall notify the Supervising Architect relative to the amount, brand and make of cement he intends to use and the place of primary shipment in ample time for the Supervising Architect to arrange for inspection and certification of shipments. All cement of its kind should be obtained from the same place to avoid possible delay due to the additional time required for making inspections at several places.

84. Federal Specification SS-C-191 provides that cement remaining in storage prior to shipment for a period greater than six months after test shall be retested.

85. Tests and inspection will be made at Government expense. After a cement has been approved, no change in brand or make will be permitted for this contract unless the manufacturers cannot make satisfactory delivery.

86. LIME shall be either hydrated lime complying with Federal Specification No. SS-L-351, or pulverized quick lime complying with Federal Specification No. SS-Q-351, type "C". Quick lime shall pass a No. 20 sieve and at least 90 per cent shall pass a No. 50 sieve.

87. CEMENT AND LIME shall be delivered in the original packages and kept dry until used.

88. LIME PUTTY shall be a stiff mixture of lime and water, thoroughly slaked and allowed to cool. Putty shall soak at least 24 hours, after cooling, and be kept moist until used.

89. SAND shall be sharp, clean and well graded in size. It shall be free from organic matter. When dry, at least 97 per cent shall be retained on a No. 100 sieve and 80 per cent on a No. 50 sieve. Sand for concrete shall pass a No. 4 sieve and at least 10 per cent shall be retained on a No. 10 sieve. Sand for mortar shall pass a No. 8 sieve and at least 5 per cent shall be retained on a No. 16 sieve.

90. AGGREGATE shall be clean broken trap rock or granite that will be retained on a 1/4 inch screen and pass a 1-inch screen and shall be well graded in size from fine to coarse. Sizes specified for aggregate are the maximum acceptable and represent standard screen sizes.

91. WATER shall be fresh, clean and free from alkali.

92. MIXTURES.--Proportions specified are in equal parts by volume. One sack of Portland cement (94 pounds net) shall be considered equal to 1 cubic foot. All cement shall be Portland cement, unless otherwise specified.

Concrete mixtures shall be as follows:

Class A. 1 of cement, 1-1/2 of sand and 3 of aggregate.
Class C. 1 of cement, 4 of sand and 8 of aggregate.

Mortar mixtures shall be

1 of cement and 2 of sand.

CONCRETE WORK.

93. CONCRETE.—Concrete shall be Class A with 3/4 inch aggregate for all work except Concrete so noted. See drawing No. 1-409, which shall be Class C with 3/4 inch aggregate.

94. PROTECTION FROM COLD.--No concrete or cement work shall be done in freezing weather unless suitable means are used to heat the materials before placing and to protect the concrete after placing so that no damage from frost or freezing shall occur. Protection after placing shall include the use of temporary heat and covering if necessary. No anti-freezing ingredient shall be mixed with concrete or cement work.

95. MIXING.—No feozen, caked or lumpy material shall be used. Materials, including water, for each batch shall be accurately measured and thoroughly mixed until evenly distributed throughout. Concrete shall be mixed with as little water as practicable to a plastic consistency that will support the aggregate and that can be readily worked into the spaces to be filled. No mortar or concrete shall be retempered for use. Mixing tools and apparatus shall be kept clean.

96. ADMIXTURE.—A mineral admixture shall be used to obtain the specified slump and plasticity of the concrete and mortar. The admixture shall have the following characteristics as determined by the United States Bureau of Standards.

> The admixture shall be finely divided silica substantially free from clay and organic matter.
>
> Not more than 1 per cent by weight of the material shall be retained on a No. 30 sieve and not more than 15 per cent by weight shall be retained on a No. 200 sieve.
>
> The admixture shall not contain more than 3 per cent by weight of moisture.
>
> A moisture free sample of the material shall show a loss of not more than 5 per cent by weight on ignition at 1800 degrees F.
>
> An ignited sample shall contain at least 83 per cent by weight of silica and not over 3 per cent by weight of alumina.
>
> An air dry sample of the material shall not contain more than 3 per cent by weight of alkalies or other water-soluble deleterious substances.
>
> The quantity of admixture used will depend upon the proportions of the concrete mix and shall not be less than the following amounts per sack (94 pounds net) of cement used:
>
> Two pounds for 1: 1-1/2: 3 concrete.

The efficiency of the admixture shall be such that when mixed in the above proportions the total water content of the concrete mix shall not exceed 7-1/2 gallons per sack of cement to give a minimum slump of 3 inches and a maximum slump of 6 inches when tested as specified herein under "Slump Test".

97. For Class A concrete, slight variations from the specified proportions of sand and aggregate shall be made as approved by the Construction Engineer when necessary to do so in order to obtain the required workability. No change will be permitted that increases the combined quantities of sand and aggregate beyond that specified, and in no case shall the quantity of aggregate be less than one-half or more than two-thirds the combined quantities of sand and aggregate.

98. Sand and aggregate shall be separately stored and separately measured as used. The quantities of material for each batch shall be measured by mechanical measuring devices and shall be either by weight or by volume at the option of the contractor. If measured by volume, the sand shall be completely saturated by inundation when measured. If measured by weight, the quantities of sand and aggregate used shall be on the basis of bone-dry material and proper deduction shall be made for any water present in the sand and aggregate at the time of measuring.

99. The amount of water used in each batch shall be only such predetermined quantity as is necessary to produce concrete of the specified consistency and slump. In no case shall the total quantity of water present in each batch exceed 5-1/2 gallons per sack of cement used. Automatic correction of the water measure shall be in accordance with the varying moisture content of the sand and aggregate.

100. Measuring devices shall be as nearly automatic as practicable and shall be so calibrated that the contents at any setting may be readily determined. The measuring devices used shall be subject to the approval of the Supervising Architect or his authorized representative. Wheelbarrows or other approximate measurements shall not be used.

101. Concrete may be mixed at a central mixing plant, provided the contractor makes such arrangements as will assure the Construction Engineer to his satisfaction that the materials are being mixed and the concrete delivered under conditions that will provide a finished product meeting the contract requirements in all respects.

102. The Construction Engineer shall have free access at all times to the mixing plant for inspection and sampling of all materials being furnished and work performed for this particular project, and such privilege shall not be construed to relieve the contractor of his responsibility for compliance with the contract requirements.

103. When the concrete is dumped at the place of deposit, it shall have the specified consistency and workability and shall be placed immediately in its final position. If necessary, the concrete shall be delivered to the job in trucks so designed and operated that the concrete will be thoroughly mixed during the time that it is in transit.

104. SLUMP TEST.—Concrete shall be tested for consistency at the mixer. A complete batch shall be mixed as specified and then dumped. The sample shall be taken immediately from the batch and tested under the direction of the Construction Engineer. The test shall conform to tentative Standard D-138 of the American Society of Testing Materials. The slump shall not exceed 4 inches.

105. Forms.—Forms shall be tight and rigid to sustain the concrete without leakage or distortion and shall be clean inside when the concrete is poured. Forms shall be left in place until the concrete is safely self-supporting and shall be removed without damage to the concrete.

106. Forms for concrete exposed as a finished surface shall have smooth faces with tight, flush joints and shall be accurately shaped and set to the required lines and levels.

107. METAL REINFORCEMENT.—Reinforcing metal shall include stirrups, spacers, ties, etc., as required and necessary for assembling, placing and supporting the reinforcement in place. Metal shall be clean and free from scale or flake rust or any coating. Fabric may be zinc coated. Metal shall be kept clean until used, or be cleaned with wire brushes before placing.

108. Bars shall conform to Federal Specification No. 350A (QQ-B-71). Bars not otherwise specified shall be type B, Grade 2 and may be any class.

109. Metal fabric shall be either steel wire or expanded sheet steel. Sustaining members shall be not less than 3 inches nor more than 8 inches apart. The length of mesh shall not exceed 16 inches. Areas specified are the net sectional area of sustaining members only per foot of width.

110. Areas of metal fabric when noted on the drawings are for wire fabric. Where areas of fabric are not indicated, the area shall be at least 0.135 sq. in. for expanded metal and 0.08 square inch for wire fabric. The manufacturer's catalogue designation of metal fabric to be used shall be submitted for approval of the Supervising Architect.

111. Where the type of reinforcement is not definitely indicated on the drawings metal fabric shall be used.

112. SHOP DRAWINGS.—Bending and assembling diagrams showing shapes, dimensions and details of rods and bars and accessories for securing and supporting the same shall be submitted in quadruplicate for the approval of the Supervising Architect.

113. PLACING REINFORCEMENT.—Reinforcement shall be accurately placed and securely fastened and supported to prevent displacement before or during the pouring of the concrete.

114. Reinforcement shall be inspected in the forms and approved in writing by the Construction Engineer before the concrete is poured. The contractor shall forward a copy of the written approval to the Supervising Architect.

115. PLACING CONCRETE.—Concrete shall be so handled as to maintain its consistency and not permit the ingredients to separate. It shall be placed immediately after mixing, and shall be so rodded, tamped or worked into place that no voids or segregation of the aggregate shall show when the forms are removed.

116. CONSTRUCTION JOINTS SHALL BE AVOIDED WHERE POSSIBLE IN WORK THAT IS SHOWN CONTINUOUS. VERTICAL JOINTS SHALL BE TONGUED OR TENONED TO BOND THE CONNECTING SECTIONS. HORIZONTAL JOINTS SHALL BE FREE FROM SOFT OR SPONGY MATERIAL AND SHALL HAVE A PERFECT BOND BETWEEN THE LAYERS OF CONCRETE.

117. REINFORCED WORK SHALL BE POURED CONTINUOUSLY IF POSSIBLE. WHERE CONSTRUCTION JOINTS CANNOT BE AVOIDED THEY SHALL BE PERPENDICULAR TO THE AXIS OR SURFACE OF THE MEMBER JOINTED AND AT THE CENTER OF THE SPAN. IF AN INTERSECTING MEMBER OCCURS AT THAT POINT, THE JOINT SHALL BE OFF-SET TWICE THE DEPTH OF THE INTERSECTING MEMBER.

118. ANCHORS, BOLTS, SLEEVES, DOWELS, ETC., AS REQUIRED SHALL BE PROPERLY LOCATED AND BUILT IN AS THE WORK PROGRESSES. SLOTS SHALL BE FORMED OR ANCHORS BUILT IN AS DIRECTED FOR BONDING ABUTTING MASONRY WALLS.

119. EXPOSED SURFACES OF CONCRETE WITHOUT OTHER FINISH SHALL BE TRUE TO LINE, REASONABLY SMOOTH, WITH FULL ARRISES AND FREE FROM BURRS, FINS AND HOLES.

120. CONCRETE SHALL BE PROTECTED AGAINST RAPID DRYING AND SHALL BE KEPT MOIST FOR AT LEAST SIX DAYS.

121. IMPERFECTIONS SHOWING IN EXPOSED SURFACES OF CONCRETE SHALL BE CORRECTED AND MADE GOOD. NO POINTING OR PATCHING SHALL BE DONE, OR RESTORATION OF BROKEN SURFACES OR ARRISES BE COMMENCED, UNTIL SUCH PLACES HAVE BEEN INSPECTED AND PASSED UPON BY THE CONSTRUCTION ENGINEER.

CONCRETE PILING

122. SCOPE.--For the number and length of concrete piles required, see drawings. All piles shall be furnished and driven as shown on the drawings and described herein. Piles shall be pre-cast.

123. MATERIALS and proportions for concrete are specified under "Cements, Aggregates and Mixtures". Piles may be picked up and driven when the concrete has attained a compressive strength of not less than 3000 pounds per square inch. However before any handling of piles will be permitted the contractor must have them tested, at his own expense, by a recognized agency acceptable to the contracting officer and a complete report of the test furnished to the Supervising Architect and to the Construction Engineer as soon as completed.

124. PILES.--Square piles shall have chamfered corners. Piles shall be of constant cross section with tapered points as shown. Before beginning work the contractor shall submit the description of the method of installation, all of which shall be subject to the approval of the Supervising Architect.

125. Forms shall be tight and rigid to prevent leakage or distortion and shall be arranged so that forms and reinforcing steel may be vibrated while pouring the concrete. All piles shall be plainly marked with the casting date. Piles shall be protected against frost or other damage and kept wet for at least 14 days after casting. No pile shall be driven until it is thoroughly seasoned to the satisfaction of the Construction Engineer.

126. DAMAGED PILES.--Should any pile be damaged or diverted from its proper position in the course of driving, or otherwise not conform with the contract requirements, this pile shall be withdrawn and another driven in its place. If it is not possible to withdraw the damaged or defective pile, another pile shall be driven as near as practicable to it.

127-8. All piling that has been distorted by the driving shall be corrected to the entire satisfaction of the Construction Engineer. Care shall be used in bringing sheet piling into line so that piles will not be stressed to the point of injury to the pile. Piles shall be driven within 3 inches of location, not more than 1/8 inch per foot from direction indicated, and the tops brought to or cut off at within 2 inches of the elevation indicated.

129. The contractor shall furnish the Supervising Architect through the Construction Engineer a descriptive catalog of the steam hammer he proposes to use and a statement giving the weight of the ram plus the total effective steam pressure on the piston.

130. Steam hammers shall develop an energy per blow at each full stroke of the piston of at least 12000 foot pounds.

131. Water jets shall be used in driving where the going is hard. Excessive hammering of piles will not be permitted as it is the desire to keep the piles as near as possible in the location shown and to avoid broken or damaged piles.

132. All cushions or followers placed between the striking part of the hammer and the pile and all pile driving equipment must be approved by the Construction Engineer. No free swinging leads will be permitted and the equipment shall provide adequate support to firmly hold a pile or pile follower in correct position while being driven.

133. UNIT PRICES.--Bids shall be based on the number and lengths of piles indicated on the drawings, measuring individual piles from tip to cut-off. If the actual conditions at the site require the use of longer piles than those indicated, the contractor shall furnish piles of the necessary length and the contract price will be adjusted on the basis of $1.60 additional for each linear foot in excess of the individual lengths indicated on the drawings or 80 cents less for each lineal foot less than the individual lengths indicated on the drawings. No extra payment will be made for withdrawn defective, damaged or misplaced piles, nor for portions of piles above the cut-off level.

STEEL SHEET PILING

134. Interlocking steel sheet piling shall be driven to true lines and elevations indicated on the drawings and shall be free from twist or warp.

135. Steel piling shall be new or in condition equal to new.

136. Steel piling shall be of the integral rolled interlocking steel type and shall be straight or arched webb, channel or extended channel in section, with a uniform thickness of webb metal of 3/8 inch. The contractor shall submit the name of manufacturer of sheet piling he proposes to use, the manufacturer's section number and the section numbers for corner sections, to the Supervising Architect for approval.

137. The piling shall be rolled from open hearth steel conforming with Federal Specification No. 352A Classes "B" and "D".

138. Steel sheet piling shall be guaranteed sand tight. Any leaks developing that cannot be otherwise stopped shall be stopped by driving sheet steel piles at the back of the wall.

139. The interlock of all piling sections shall be capable of withstanding a pull of not less than 7500 lbs. per linear inch of interlock at yield point, and 9500 lbs. at failure, and so designed as to permit a change of 15 degrees in direction to the right or left of line.

140. No splicing of sheet piling will be permitted when same is driven for permanent use.

141. TAPER PILING SHALL BE FURNISHED AND DRIVEN IF NECESSARY TO KEEP WALLS PLUMB AND IN ALIGNMENT FOR BOTH VERTICAL AND SLOPING WALLS.

142. THE DRIVING OF THE PILING MAY BE COMPLETED AT THE FIRST DRIVING, BUT ANY PILE DRIVEN BELOW GRADE OR CARRIED DOWN BY THE DRIVING OF ADJACENT PILING SHALL BE WITHDRAWN TO BRING THE TOP OF THE WALL TO REQUIRED ELEVATION.

143. THE WORK MAY BE CARRIED OUT BY DRIVING THE ENTIRE WALL TO WITHIN ONE FOOT OF FINISHED GRADE AND THEN BACKING OVER SAME AND CAREFULLY BRINGING THE TOPS TO REQUIRED ELEVATION.

TIMBER PILE FOUNDATIONS

144. SCOPE.--FOR THE NUMBER AND LENGTHS OF PILES REQUIRED, SEE STRUCTURAL DRAWINGS. ALL PILES SHALL BE DELIVERED IN GOOD CONDITION, ACCURATELY DRIVEN AND CUT OFF AT THE ELEVATION INDICATED.

145. UNIT PRICES.--BIDS SHALL BE BASED ON THE NUMBER AND LENGTHS OF PILES INDICATED ON THE DRAWINGS, MEASURING INDIVIDUAL PILES FROM TIP TO CUT-OFF. IF THE ACTUAL CONDITIONS AT THE SITE REQUIRE THE USE OF LONGER PILES THAN THOSE INDICATED, THE CONTRACTOR SHALL FURNISH PILES OF THE NECESSARY LENGTH AND THE CONTRACT PRICE WILL BE ADJUSTED ON THE BASIS OF $1.00 ADDITIONAL FOR EACH LINEAR FOOT OR FRACTION THEREOF IN EXCESS OF THE INDIVIDUAL LENGTHS INDICATED ON THE DRAWINGS. NO EXTRA PAYMENT WILL BE MADE FOR WITHDRAWN, DEFECTIVE, DAMAGED OR MISPLACED PILES, NOR FOR PORTIONS OF PILES ABOVE THE CUT-OFF LEVEL.

146. PILES SHALL BE YELLOW PINE, DOUGLAS FIR OR SPRUCE AND SHALL BE CUT FROM SOUND, LIVE TIMBER. THE MINIMUM DIAMETER TWO FEET FROM THE BUTT END SHALL BE 12 INCHES. THE MINIMUM DIAMETER AT THE TIP SHALL BE 8 INCHES FOR PILES UP TO 50 FEET LONG, AND 7 INCHES FOR PILES OVER 50 FEET LONG. ALL DIAMETERS SHALL BE MEASURED UNDER THE BARK. YELLOW PINE PILES SHALL CONTAIN AT LEAST 30 PER CENT SAPWOOD.

147. PILES SHALL BE CUT ABOVE THE GROUND SWELL, SHALL HAVE A UNIFORM TAPER AND SHALL BE FREE FROM SHORT KINKS. A STRAIGHT LINE CONNECTING THE CENTERS OF BOTH ENDS SHALL LIE WHOLLY WITHIN THE PILE. ALL KNOTS SHALL BE SOUND AND NO KNOT OR KNOT CLUSTERS SHALL HAVE AN AVERAGE DIAMETER EXCEEDING ONE-THIRD THE DIAMETER OF THE PILE AT THE POINT WHERE THE KNOT OCCURS. KNOTS SHALL BE TRIMMED CLOSE. ANY DEFECTS OR COMBINATION OF DEFECTS MORE INJURIOUS THAN THE MAXIMUM KNOT ALLOWANCE SHALL NOT BE PERMITTED.

148. DRIVING.--ALL WOOD PILES (BOTH TENSION AND COMPRESSION) SHALL BE DRIVEN TO A FINAL PENETRATION WHICH WILL SAFELY SUPPORT A LOAD OF 15 TONS. PILES SHALL NOT BE DRIVEN UNTIL AFTER THE EXCAVATION IS COMPLETED. ALL PILES SHALL BE DRIVEN IN THE PRESENCE OF THE CONSTRUCTION ENGINEER. THE DRIVING SHALL BE CONTINUOUS FOR EACH PILE FROM THE TIME OF STARTING UNTIL THE REQUIRED PENETRATION HAS BEEN REACHED. CAPS, COLLARS OR BANDS SHALL BE PROVIDED AND USED AS NECESSARY TO PROTECT THE PILES AGAINST SPLITTING AND BROOMING.

149. PILES SHALL BE DRIVEN WITH A VARIATION OF NOT MORE THAN 1/8 INCH PER FOOT FROM THE DIRECTION SHOWN. PILE HEADS SHALL BE WITHIN 3 INCHES OF THE LOCATION SHOWN, AND CUT OFF WITHIN 2 INCHES OF THE REQUIRED ELEVATION, LEAVING SOUND HEADS. PILES THAT ARE DRIVEN TOO LOW TO CUT OFF AT THE ELEVATION SPECIFIED SHALL BE WITHDRAWN AND REPLACED WITH NEW PILES. PILES RAISED DURING THE PROCESS OF DRIVING ADJACENT PILES SHALL BE DRIVEN DOWN AGAIN IF SO DIRECTED.

150. PILES THAT ARE DAMAGED OR DIVERTED IN DRIVING OR ARE STOPPED BY AN OBSTRUCTION SHALL BE EITHER CUT OFF AND LEFT OR WITHDRAWN AND THE SPACE FILLED WITH GRAVEL OR BROKEN STONE WELL TAMPED IN PLACE. IN EITHER CASE, ANOTHER PILE SHALL BE DRIVEN AS CLOSELY AS POSSIBLE TO THE REQUIRED LOCATION.

151. THE CONTRACTOR SHALL KEEP AN ACCURATE AND DETAILED LOG OF EACH PILE SHOWING THE DEPTH TO WHICH IT WAS DRIVEN, THE PENETRATION UNDER THE SERIES OF BLOWS NOTED IN THE FORMULAE SPECIFIED HEREIN AND THE GENERAL DRIVING CHARACTERISTICS.

152. THE CONTRACTOR SHALL FURNISH THE SUPERVISING ARCHITECT THROUGH THE CONSTRUCTION ENGINEER A DESCRIPTIVE CATALOG OF THE STEAM HAMMER HE PROPOSES TO USE AND A STATEMENT GIVING THE WEIGHT OF THE RAM PLUS THE TOTAL EFFECTIVE STEAM PRESSURE ON THE PISTON.

153. SINGLE ACTING STEAM HAMMERS SHALL DEVELOP AN ENERGY PER BLOW AT EACH FULL STROKE OF THE PISTON OF AT LEAST 4000 FOOT POUNDS.

154. GRAVITY HAMMERS SHALL WEIGH BETWEEN 2500 AND 3500 POUNDS AND SHALL HAVE A FALL OF NOT OVER 20 FEET.

155. WATER JETS MAY BE USED IN DRIVING WHERE THE DESIRED RESULTS CAN BEST BE OBTAINED BY THEIR USE. TO SECURE THE FINAL PENETRATION, THE JETS SHALL BE WITHDRAWN AND THE PILES DRIVEN BY THE HAMMER.

156. BEARING VALUES.--THE SAFE BEARING VALUES SHALL BE DETERMINED BY THE FOLLOWING FORMULAE:

P EQUALS 2WH DIVIDED BY S PLUS 1.0 FOR GRAVITY HAMMERS.
P EQUALS 2WH DIVIDED BY S PLUS 0.1 FOR SINGLE ACTING STEAM HAMMERS.
P EQUALS 2H (W PLUS AP') DIVIDED BY S PLUS 0.1 FOR DOUBLE ACTING STEAM HAMMERS.

IN WHICH:

P EQUALS SAFE BEARING POWER IN POUNDS,
W EQUALS WEIGHT IN POUNDS OF STRIKING PARTS OF HAMMERS,
H EQUALS HEIGHT OF FALL IN FEET,
S EQUALS THE AVERAGE PENETRATION IN INCHES PER BLOW FOR THE LAST 5 TO 10 BLOWS FOR GRAVITY HAMMERS, AND THE LAST 10 TO 20 BLOWS FOR STEAM HAMMERS.
A EQUALS AREA OF PISTON IN SQUARE INCHES.
P' EQUALS STEAM PRESSURE IN POUNDS PER SQUARE INCH AT HAMMER.

THE ABOVE FORMULAE APPLY ONLY WHEN THE HAMMER HAS A FREE FALL, THE HEAD OF THE PILE IS FREE FROM BROOMED OR CRUSHED FIBER, THE PENETRATION IS A REASONABLY QUICK AND UNIFORM RATE, AND THERE IS NO SENSIBLE BOUNCE AFTER THE BLOW.

STRUCTURAL & MISCELLANEOUS METAL WORK

157. GENERAL.--ALL STRUCTURAL AND MISCELLANEOUS METAL WORK SHALL BE FURNISHED AND INSTALLED COMPLETE WITH ALL NECESSARY ANCHORS, BOLTS, HARDWARE AND OTHER ACCESSORIES. ALL METAL WORK NOT NOTED ON THE DRAWINGS AS "GALVANIZED" SHALL BE COPPER BEARING STEEL COMPLYING WITH FEDERAL SPECIFICATION NO. 352A CLASSES "B" AND "D". METAL WORK NOTED AS "GALVANIZED" SHALL BE STEEL OR IRON ZINC COATED AFTER FABRICATION.

158. STEEL AND WROUGHT IRON SHALL BE STANDARD, WELL FINISHED, STRUCTURAL SHAPES, OR BAR STEEL OR BAR IRON. NO DISTINCTION WILL BE MADE BETWEEN STEEL AND WROUGHT IRON.

159. CAST IRON SHALL BE SOFT, TOUGH, GRAY IRON.

160. WIRE NOT OTHERWISE SPECIFIED SHALL BE COLD DRAWN STEEL.

161. MILL AND SHOP INSPECTION WILL BE MADE BY GOVERNMENT REPRESENTATIVES, UNLESS SUCH INSPECTION IS WAIVED BY THE SUPERVISING ARCHITECT. AFTER THE AWARD OF THE CONTRACT THE CONTRACTOR SHALL INFORM THE SUPERVISING ARCHITECT AS TO WHERE THE MATERIAL IS TO BE ROLLED, AND WHERE IT IS TO BE FABRICATED, AND THE ESTIMATED TONNAGE.

162. IN CASE MILL INSPECTION IS WAIVED BY THE SUPERVISING ARCHITECT THE CONTRACTOR SHALL FURNISH CERTIFIED COPIES OF THE MILL ANALYSIS SHOWING THAT THE MATERIAL TO BE USED IS IN CONFORMITY TO THE CONTRACT REQUIREMENTS.

163. COVERS AND FRAMES.--METAL OF COVERS AND FRAMES SHALL BE AT LEAST 3/8 INCH THICK. SOLID COVERS SHALL HAVE FLUSH DROP HANDLES. STOCK COVERS AND FRAMES OF SIMILAR DESIGN MAY BE USED PROVIDED CUTS OR DRAWINGS OF SAME ARE FIRST SUBMITTED TO AND APPROVED BY THE SUPERVISING ARCHITECT.

164. MAN HOLE SHALL HAVE SOLID CAST IRON COVERS AND FRAMES AS SHOWN ON DRAWING NO. 1-407. DRAIN PIPE SO NOTED SHALL BE EXTRA HEAVY CAST IRON SOIL PIPE. BRASS PIPE SHALL BE RED BRASS PIPE.

165. WORKMANSHIP.--SHEARING AND PUNCHING SHALL BE WITHOUT RAGGED OR TORN EDGES. THE DIAMETER OF THE PUNCH SHALL NOT EXCEED THAT OF THE RIVET, OR THE DIAMETER OF THE DIE EXCEED THAT OF THE PUNCH, BY MORE THAN 1/16 INCH. THE THICKNESS OF MATERIAL IN PUNCHED WORK SHALL NOT EXCEED THE NOMINAL DIAMETER OF THE RIVET PLUS 1/8 INCH. HOLES SHALL BE ACCURATELY SPACED SO THAT WHEN PARTS ARE ASSEMBLED HOT RIVETS WILL ENTER WITHOUT DISTORTION. HOLES SHALL BE ENLARGED ONLY BY REAMING. DRIFT PINS SHALL NOT ENLARGE OR DISTORT THE HOLES.

166. Rivets shall have well finished concentric heads in full contact with the metal. All rivets shall be tight. Shop rivets shall be machine driven. Riveted parts shall be closely drawn together before riveting. Shop connections generally shall be riveted.

167. Eye bars shall be true to length within 1/32 inch and bars packed on the same pin shall be drilled at the same setting. Pins shall be standard turned pins.

168. All members shall be free from twists, kinks, buckles or open joints. Parts assembled with rivets or bolts shall be in close contact, except where separators are required. All members shall be so accurately made that when assembled the parts shall come together without distortion and without shimming.

169. Wrapped Work.--Tie rods so noted shall be painted with coal tar pitch and then wrapped uniformly with coal tar saturated cotton fabric. Coal tar shall conform with Federal Specification No. R-P-361 and cotton fabric shall be plain cotton, weighing at least 4 ounces per square yard without sizing and woven approximately 22 threads per inch in both directions.

170. Erection.--All structural and miscellaneous metal work shall be accurately set and properly secured in place. Unless otherwise specified field connections of Structural Metal Work shall be riveted.

171. Bolted connections shall be made with close fitting bolts of the exact required lengths. Bolted parts shall be closely drawn together and nuts drawn up tight and bolt ends upset.

172. Bolts for structural work exposed to the weather shall be dipped in red lead paint just before they are put in place.

173. Anchor bolts and anchors shall be properly located and built into the connecting work in advance.

174. All structural metal work shall have suitable temporary braces and stays to hold it in position until permanently secure.

175. Painting.--All structural and miscellaneous metal shall be cleaned free from scale, rust and all foreign matter and, after inspection, shall be given a shop coat of paint. Surfaces in contact or inaccessible after assembling (except for pressed or open-web steel joists) shall be painted before assembling. Machine finished surfaces shall be protected from corrosion.

176. After erection the field connections and all abraded places shall be painted, and the entire work (other than wrapped work be given an additional coat of paint.

177. Painting materials shall conform to Federal Specifications, unless otherwise specified. The paint for work other than pressed or open-web steel joists shall be mixed as follows:

FIRST COAT		SECOND COAT	
RED LEAD, DRY	25 LBS.	RED LEAD, DRY	25 LBS.
RAW LINSEED OIL,	1 GALLON	RAW LINSEED OIL,	1 GALLON
TURPENTINE,	1/2 PINT	TURPENTINE,	1/2 PINT
		LAMP BLACK IN OIL,	4 OUNCES

178. NO PAINT SHALL BE USED AFTER THE PIGMENT HAS CAKED OR HARDENED. THE PAINT SHALL BE KEPT WELL STIRRED WHILE IT IS BEING APPLIED. PAINT SHALL BE THOROUGHLY BRUSHED ON AND WELL WORKED INTO JOINTS AND OPEN SPACES. ALL SURFACES SHALL BE CLEAN AND DRY WHEN PAINTED.

STONE WORK

179. GENERAL.--THE WORD "STONE" AS USED HEREIN SHALL APPLY TO ALL EXTERIOR GRANITE AS MAY BE NOTED ON THE DRAWINGS OR NAMED IN THE SPECIFICATION.

180. STONE SHALL BE SO DELIVERED, PILED AND HANDLED AT ALL TIMES AS TO PROTECT IT FROM DAMAGE. THE PATCHING OR HIDING OF DEFECTS SHALL NOT BE PERMITTED. ANY STONE CHIPPED ON THE FACE SHALL BE REDRESSED OR CLEANED TO REMOVE ALL TRACES OF SUCH DEFECTS BEFORE IT IS SET IN PLACE, OR NEW STONE SHALL BE FURNISHED. NO STONE SHALL BE REDRESSED TO LESS THAN THE MINIMUM THICKNESS ALLOWED UNDER THE CONTRACT.

181. KINDS OF GRANITE.--GRANITE SHALL BE EITHER PINK OR GRAY NEW ENGLAND GRANITE.

182. QUALITY.--STONE SHALL BE SOUND AND DURABLE, FREE FROM QUARRY SAP, SEAMS AND MINERAL STAINS AND SHALL BE OF A QUALITY, COLOR, AND TEXTURE WITHIN THE RANGE OF VARIATIONS SPECIFIED AND REPRESENTED BY THE APPROVED SAMPLES. NATURAL VARIATIONS IN COLOR AND MARKINGS CHARACTERISTIC OF THE MATERIAL THAT DO NOT, IN THE OPINION OF THE SUPERVISING ARCHITECT, IMPAIR ITS STRENGTH OR DURABILITY NOR MAR ITS APPEARANCE WILL BE ADMITTED.

183. CUTTING.--FINISHED SURFACES SHALL BE TRUE, AND FACES OF STONE IN THE SAME PLANE SHALL BE FLUSH AT THE JOINTS. BEDS AND JOINTS SHALL BE AT RIGHT ANGLES TO THE FACE OF THE STONE.

184. BEDS AND JOINTS SHALL BE CUT FULL AND SQUARE FOR A DISTANCE OF TWO INCHES BACK FROM THE FACE, FROM WHICH POINT THEY MAY FALL OFF NOT TO EXCEED 1 INCH IN 12 INCHES AND SHALL BE REASONABLY FREE FROM LARGE CUPPINGS OR DEPRESSIONS. JOINTS SHALL BE 1/2 INCH WIDE.

185. HOLES AND SINKAGES SHALL BE CUT FOR ALL ANCHORS, CRAMPS, DOWELS, ETC., REQUIRED. LEWIS HOLES SHALL BE CUT IN ALL STONES WEIGHING MORE THAN 100 LBS., EXCEPT THAT LEWIS HOLES SHALL NOT BE CUT IN EXPOSED TOP SURFACES, NOR NEARER THAN 2 INCHES TO AN EXPOSED FACE.

186. COPINGS OF PARAPETS SHALL HAVE CRAMPS IN VERTICAL JOINTS. COPINGS SHALL BE IN SECTIONS AT LEAST 5 FEET LONG UNLESS OTHERWISE SHOWN.

187. FINISH.--All granite except copings shall be pitch face. Copings shall be four-cut or equivalent sawed work. Sawed work shall be cleaned with sand blast at the mill.

188. ANCHORS, DOWELS, ETC.--Dowels shall be 6 inches long, and cut from 1/2 inch red brass pipe of iron pipe sizes. Anchors, bolts, cramps, etc., shall be steel or wrought iron and zinc coated after fabrication. Cramps shall be 1/2 x 3/4 inch x 10 inches long after bending with ends turned 1 inch into the stone. Anchors shall be as detailed on the drawings.

189. MORTAR.--Setting and pointing mortar for granite shall be 1 part cement and 2 parts sand. Sand and cement to be as specified under "Cement Aggregates and Mixtures."

190. SETTING.--All stone shall be cleaned, then sponged or drenched with clean water just before setting. Each stone shall be set level and true to line in a full bed of plastic mortar and tapped home to a full, even bearing. Vertical joints shall be filled with mortar. Joints shall be uniform and raked out 1/2 inch deep on the face for pointing. Faces of stone shall be kept free of mortar.

191. All anchors, cramps, dowels, etc., shall be accurately set and adjusted, and the holes and sinkages filled with mortar.

192. POINTING.--All face joints shall be cleaned out 1/2 inch in depth, wet thoroughly and pointed full and flush with pointing mortar.

193. CLEANING.--After the completion of the setting, coping stones shall be cleaned with stiff fiber brushes, using soap powder boiled in water, and the stone rinsed with clean water.

Jas. A. Wetmore,
Acting Supervising Architect.

Received Nov. 15/33

ELLIS ISLAND, NEW YORK,
IMMIGRATION STATION,
SEA WALL, ETC.

[illegible]

Dup

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4

ADDENDUM NO. 1 TO THE SPECIFICATION DATED NOVEMBER 7, 1933, FOR SEA WALL, ETC., FOR THE UNITED STATES IMMIGRATION STATION AT ELLIS ISLAND, NEW YORK.

Treasury Department, Procurement Division, Public Works Branch,
Washington, D. C., November 14, 1933.

Bidders are informed that the above named specification is hereby modified as follows:

SPECIFICATIONS

Par. No. 75- Second word should be "back" instead of "both".

Par. No. 63- Omit.

Par. No. 90- Second line, omit the word 1-inch and substitute for same 3/4 inch.

Par. Nos. 109 and 110- Omit and substitute for same the following:

Reinforcement for concrete encased steel work including 12 inch channels shown on drawing No. 1-405 shall be steel fabric not lighter than 16 gauge. Expanded metal shall be 3 x 7 inch or 3 x 8 inch mesh and weigh at least 1.8 lbs. per square yard. Wire fabric shall be zinc coated and shall be either 2 inch hexagonal mesh weighing 1-1/2 pounds, or 2 inch square mesh weighing 1.17 pounds, or 4 x 4 inch mesh weighing at least 1-1/4 lbs. All weights are per square yard.

Par. No. 123- Add the following after the first sentence: "Concrete shall be Class A".

Par. No. 127-8- Revise the third sentence to read as follows: Piles shall be driven in the position shown on the drawings and shall not vary more than 1/8 inch per foot from the direction indicated, and the --- etc.

Par. No. 176- Omit.

DRAWINGS

Drawing No. 1-402 -- Section No. 1 of sea wall shall be constructed parallel to the bulkhead now in place at that location.

Drawing No. 1-405 -- All 1-3/4 inch and 2 inch diameter bars shall be painted and wrapped as detailed on drawing No. 1-402 instead of being galvanized.

HFH

DMF

(Over)

In Section [illegible], piles marked 12 inch square are to be 14 inch square; also horizontal bars in pile cap are to be 1 inch diameter rounds.

Drawing No. 1-408- The "Anchorage Details for corner 'Z'" the steel sheet piling is to be provided with a wall at the top, composed of two six-inch channels, as shown on Drawing No. 1-407 at "Anchorage Details at Corner 'X'".

Drawing No. 1-406- "Detail of Flow Ways", the horizontal 3 inches x 12 inches should be gained 2 inches into the supporting piles.

All sections of sea wall shall be reinforced with 1 inch diameter round bars as shown by "Typical Section through new wall and Pile Anchor" on drawing No. 1-403.

In paragraph No. 96 of the Specifications, Tenth Section, revise the third, fourth and fifth lines to read as follows:

"Shall not exceed 5-1/2 gallons per sack of cement to give a maximum slump of 4 inches when tested as specified herein under slump test"

NOV 11

Bidders must acknowledge on the form of bid the receipt of this addendum.

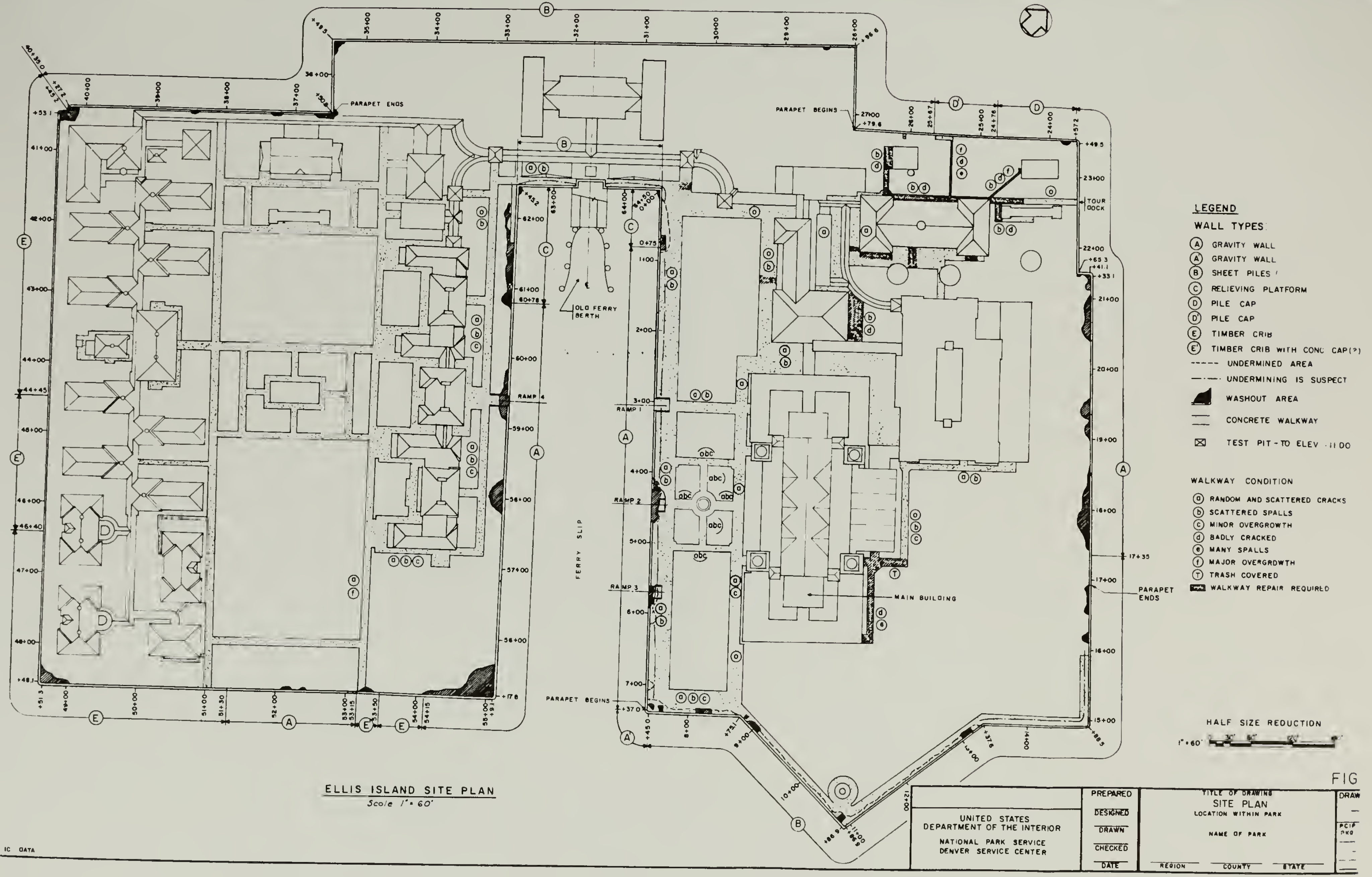
Jas. A. Wetmore,
Acting Supervising Architect.

DMF

APPENDIX E.

Graphic Summary of URS/Madigan- Praeger Condition Survey, 1976

From Seawall Rehabilitation and Walk Repair –Ellis Island, *URS/Madigan- Praeger, Inc., August 1976*



ELLIS ISLAND SITE PLAN

Scale 1" = 60'

APPENDIX F.

Analysis of Seawall Concrete, 1976

From Seawall Rehabilitation and Walk Repair –Ellis Island,
URS/Madigan- Praeger, Inc., August 1976, Appendix

DUNN
GEOSCIENCE CORP.

5 NORTHWAY LANE, NORTH
LATHAM, NEW YORK 12110
(518) 783-8102

HK

RECEIVED
AUG 1976
MADIGAN-PRAEGER

August 30, 1976

URS/Madigan-~~Praeger~~
150 East 42 Street
New York, NY 10017

Attention: Mr. Sidney Johnson

RE: Examination of concrete fragments from the Ellis Island sea wall

Gentlemen:

This letter reports our findings concerning several fragments of deteriorated concrete and a short piece of concrete core. The samples were delivered to our offices on August 16, 1976, after a phone conversation with Mr. Johnson giving DGC authorization to examine and report on the samples.

The purpose of the examination was to describe in detail the nature of the concrete fragments delivered, relate the physical and chemical condition of the fragments to possible causes of deterioration, and relate the possible causes of deterioration to the physical environment from which the concrete was taken.

A total of approximately three pounds of fragments was delivered, consisting of various-sized fragments and one piece of core about three inches long. Only a crude indication of depth within the structure was given, and orientation and exact position of the fragments are unknown. The setting from which the concrete was taken was described in several phone conversations by Mr. Johnson. The site was not visited nor were photos or sketches supplied to give more exact relationships. Three samples of material, representing chemical reaction products, have been sent for X-Ray analysis, but at this writing, the results have not been received. The purpose of these analyses is to verify the petrographic examination.

Description of the Sample

Aggregate

The coarse aggregate consists of approximately 95 percent rounded quartz and quartzite, ranging in color from clear through white, gray, and pink to tan. Also pebbles of micaceous gneiss and traprock (basalt) are found. This aggregate is typical of the type of gravel once extensively mined from Long Island. The fine aggregate consists of clear to white to gray quartz with minor amounts of feldspar, mica, magnetite, garnet, amethyst and some rock fragments. In general the sample represents a very high quality aggregate of which the only problem could be a potentially deleterious alkali reaction from a high alkali cement, particularly if some of the quartz was strained or had an opaline component.

Concrete

The samples consist of irregularly shaped, "slabby" pieces of concrete that is quite fragile and easily broken. The pieces have a white, coated appearance. In approximately 85 percent of the cases, the aggregate-concrete bond breaks or has broken around the aggregate, indicating a weakening of this bond. The original portland cement has almost completely disintegrated. The probable mineralogic composition of the present cementing material is hydrous alkali siliceous glass which appears opaline in part, with minor gypsum and calcite. The alkalic glass and gypsum have not been verified through x-ray analysis or chemical tests, but calcite is indicated by effervescence in dilute hydrochloric acid.

The calcite and possibly gypsum line most aggregate pockets in the concrete. The alkali glass cuts across quartz pebbles, surrounds some quartz pebbles and fills some pockets. The glass tends to be translucent and glassy at the outer lining of the pocket and opaque and white with an earthy luster in the center. Reaction rims both within and surrounding the aggregate particles are very common, affecting 75 percent or more of the coarse aggregate. The exact nature of these rims has not been determined.

The concrete is essentially devoid of entrained air. There are also very few open bubbles which would be expected in this concrete as entrapped air. However, there are numerous almost perfectly round masses of glassy to earthy alkali silica (?) that are probably fillings in former (entrained air) voids.

Probable Causes of Concrete Disintegration

The breakdown of the concrete can be described as primarily due to chemical actions assisted by physical processes. The deterioration of the portland cement paste appears to be due to chemical action with sea water which is high in alkali and rich in sulfate. The abundance of the white coating of calcite is the result of carbonization, and the reaction product, calcite, has concentrated at the aggregate-concrete boundary. The presence of what is most likely gypsum, as botryoidal masses and small crystals, indicates a reaction with the sulfate in sea water. The common appearance of probable alkali silica material around aggregate particles as part of the cementing matrix, filling in entrained air voids, and probably replacing former aggregate particles, indicates moderate to extensive alkali reactivity between the sea water, the aggregate, and the concrete matrix. Evidence of these reactions has been observed in every fragment of concrete as well as in the piece of concrete core.

Each of the above reactions leads to an expansion in volume and thus, incipient or open fractures may be expected. It is possible that water in these fractures could be subject to one or more cycles of freezing and thawing each year, however, this is not considered to be a serious factor. With the exception of the outermost portion of the concrete structure, the concrete is most probably completely saturated throughout the year and thus, cyclic wetting and drying is not considered to be a factor.

Possible Relationship to the Physical Environment

The portion of the sea wall undergoing the most severe deterioration has been described as being from the high water mark to several feet below the low water mark, approximately the limits of the wave zone. The deteriorated zone is also reported to be adjacent to vertical expansion joints in the sea wall. The concrete samples examined are further reported to be from behind a granite block facing, some of which is missing and from which all the pointing has been lost.

The pervasiveness of the chemical reaction products, and their apparent occurrence in several concrete units separated by expansion joints suggests that the chemical reactions have taken place, to a greater or lesser extent, throughout the concrete structure. However, the area of severe deterioration within the wave zone and along expansion joints where the flowing water has the greatest access to the structure indicates that flowing water is a major factor in the deterioration of the concrete. The flowing water has probably had two effects on the concrete: it removes the products resulting from the chemical activity, and it removes by physical action the less well-cemented fragments, consequently exposing more concrete to the deterioration process.

Based on the examination of the sample of concrete supplied to us and the description of the environment, the condition of this concrete could possibly have been ameliorated in several ways. Air-entrained concrete could have better absorbed the expansive forces of the chemical reactions. Low-alkali cement and less siliceous aggregate would have decreased the extent of the apparent alkali reactions. More complete and permanent facing, blocking the action of flowing water on the concrete, would have decreased the erosive force of the sea water.

When the results of the x-ray analyses are available, we will send a brief addendum to this report unless the results require a complete re-evaluation of our findings. In that case, we will contact you immediately to consider possible courses of action.

If you have any questions about this work, please contact us. We enjoyed working with you and look forward to assisting you in the future.

Sincerely yours,

George M. Banino /jee.

George M. Banino
Vice President

jh

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DATE DUE

National Park Service
U.S.Department of the Interior

Historic Architecture Program
Northeast Region
Boott Cotton Mills Museum, 4th Floor
400 Foot of John Street
Lowell, MA 01852

EXPERIENCE YOUR AMERICA ™

Photograph from National Archives and Records Administration.
College Park, MD